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COMMONWEALTH OF MASSACHUSETTS

DEPARTMENT OF PUBLIC WORKS

HIGHWAY MAINTENANCE DIVISION

REDUCED SALT EXPERIMENTS

1986 – 1987

REPORT ON REDUCED SALT EXPERIMENTS: 1986-1987

TABLE OF CONTENTS

		Page
I.	Introduction	1
II.	Route 128 - Cambridge Reservoir	4
III.	Cape Cod	9
IV.	Low Salt Areas in the Vicinity of Municipal Water Supplies	15
	Belchertown - Pelham	16
	Granby	17
	Orange	18
	Goshen	19
	Cummington	19
	Belchertown	20
	Athol	21
	Boylston	22
	Auburn	22
	North Reading	23
	Avon	24
	Abington - Rockland	25
V.	Reduced Salt Application on Low Volume Secondary Roadways	28
	Blandford	29
	Sutton - Milbury	30
	Southborough - Westborough	30
	Brimfield - Wales	31
	Salisbury	32
	Mansfield	33
	Acushnet - Fairhaven	33
	Freetown - Berkley - Lakeville - Taunton	34
	Canton - Westwood	34
VI.	Calcium Magnesium Acetate	36
VII.	Verglimit - Plus Ride	43
VIII.	Recommendations	44

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APPENDICES

Page

A. Route 128 Data

B. Accident Rates

C. Water Analysis Data

D. Sample District Reporting Forms

E. Public Information Material

F. Salt Reduction Data for Cape Cod

REPORT ON REDUCED SALT EXPERIMENTS

I. Introduction

In response to public concern for the quality of drinking water in Massachusetts, the Department initiated an ambitious program to reduce sodium chloride (salt) use on state highways during the 1986-1987 winter season. The program consisted of a series of experiments to reduce actual quantities of deicing materials applied to the road surface in special salt sensitive areas and other experimental areas. In addition, the Department field tested a new material known as calcium magnesium acetate (CMA) as an alternative to sodium chloride. The objectives of these experiments were 1) to determine whether it is feasible to reduce salt and continue to keep the highways safe for winter travel; 2) to reduce the measured salt concentrations in certain drinking water supplies; 3) to attempt to establish a salt application policy that allows the Department to maintain a reasonable level of service; and 4) to give field personnel experience and training in low salt operations. This report is intended to describe and evaluate the specific experiments performed by the Department in 1986-1987. It is not meant to draw any conclusions about salt application for the entire state or, in any way, to substitute for the full evaluation that will result in a new Generic Environmental Impact Statement. The final section of the report will make recommendations for the continuation of the experimental program for 1987-1988.

The policy of the Department since 1975 has been to apply straight sodium chloride to all state highways at a uniform rate of 300 pounds per lane mile. Past experience indicated that this practice was the most effective and efficient way to maintain the roadways during ice and snow storms in a condition safe for public use. In addition to the state's applications, all municipalities, private commercial establishments, and residential developments use sodium chloride to clear streets and parking areas of snow and ice. During recent years, however, public attention has focused on the environmental effects of sodium chloride. There has been increasing public concern about its infiltration into drinking water supplies, resulting in some instances in sodium levels in excess of twenty milligrams per liter, the level at which the Department of Environmental Quality Engineering (DEQE) requires public water suppliers to notify their customers.

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In response to these concerns, the Department planned and executed the five groups of salt reduction experiments described below.

The first test area involved the application of Pre-Mix and sand instead of straight salt. Pre-Mix is composed of four parts sodium chloride and one part calcium chloride. This was applied to a section of Route 128 and parts of Interstate 95 in the Hobbs Brook and Stony Brook Reservoir areas. This is a salt sensitive area, because these reservoirs supply much of the drinking water for the City of Cambridge. The objective was to reduce sodium application by twenty percent.

The second test area was on Cape Cod. A mixture of four parts sand to one part salt was evaluated for its effectiveness on all state highways on the Cape, with the exception of Route 6 and Route 28 to Falmouth. A one to one sand and salt mixture was used on Routes 6 and 28. Cape Cod is considered salt sensitive, because it has a sole-source aquifer that supplies water to the entire Cape.

The third set of test areas were those classified by DEQE as "salt sensitive", because they are adjacent to municipal water supplies. The Department of Public Works selected from the DEQE list those salt sensitive areas in which salt reduction was feasible. A mixture of one part sand to one part sodium chloride was applied in these areas.

Low volume secondary state highways were the subject of the fourth set of tests. These are not salt sensitive but were selected to determine the feasibility of salt reduction on secondary roads. Material applications consisted of a mixture of one part sand to one part sodium chloride here also.

The fifth experiment was the evaluation of calcium magnesium acetate on segments of Route 138 in Somerset.

Finally, this report includes a brief discussion of the pavement additive experiments. These include Verglimit and Plus Ride.

Because public awareness was critical to the success of the salt reduction programs for public safety and community relations reasons, the Department made special efforts to inform the public fully in each of the test areas. The Department notified the local Board of Selectmen and the municipal and state police departments of the program and its possible impact on the motoring public. In some instances, public hearings were held when requested by the Selectmen. Further, the Department's

Public Information Office sent press releases to local newspapers and radio stations advising the public of the Department's planned policy changes. In conjunction with the media programming, the Department installed new highway signs delineating the reduced salt areas and the CMA test area.

This report includes a discussion of each of the five sets of experiments. Supporting data is provided in the appendices. Appendix A contains charts and graphs depicting quantities of deicing materials applied and lane miles in the test area in the Route 128 Hobbs Brook Reservoir project. Appendix B is an analysis of accident rates on several of the test areas during icy and snowy conditions. The water analysis data that was provided by DEQE and compiled by the Department's Research and Materials Division is shown in Appendix C. This data covers a period only through 1985. It is anticipated that DEQE will provide the data for 1986 and 1987 when it is available. It will be continually updated as the Department receives it in order to provide a basis for future analysis.

Appendix D contains completed sample copies of material reporting forms. It was determined before beginning the experiments that it was necessary to have a more accurate and reliable means of keeping records of quantities of deicing material used and where it was applied. Therefore, the Highway Maintenance Division devised reporting forms, now known as the Material Control System, to be completed during storms by both foremen and engineering personnel assigned to monitor the various projects. The forms were filled out on a storm by storm basis and compiled by District Snow and Ice Engineers. District personnel received special training in the use of these forms and their importance to the program. The compilation of the forms is too voluminous to be included in this report and will be kept on file by the Highway Maintenance Division in Boston. These reports played an integral role in determining the degree of success of all of these initiatives, providing actual analysis by key supervisory personnel.

Appendix E provides a public opinion briefing and a compilation of newspaper articles. This material has been furnished as an indication of public opinion on the individual initiatives that were undertaken during the 1986-87 season. Finally, data showing salt reduction on Cape Cod is shown in Appendix F.

II. Route 128 - Cambridge Reservoir

The HOBBS BROOK RESERVOIR SODIUM CHLORIDE STUDY was completed in November, 1985 by Geotechnical Engineers Inc., of Winchester, MA. This report was commissioned and jointly funded by the Department and the City of Cambridge to determine the sources of elevated sodium levels in the municipal water supply and potential remedial actions.

Two of the principal sources of drinking water for the City of Cambridge are Hobbs Brook Reservoir and Stony Brook Resevoir. Both are located close to Routes 128, 2, and 2A. The Hobbs Brook report concludes that the salt applied to all roadways in both the Hobbs Brook and Stony Brook watershed contributes to the total sodium levels in the Cambridge water supply. The report further states that remedial measures are necessary in order to alleviate the infiltration of sodium into the city's drinking water supply. It outlines remedial measures for consideration. If no action is taken, the modeling in the study indicates that sodium levels will remain at their present level.

After serious consideration of several proposals presented by Geotechnical Engineers, Inc., the Department decided to adopt a modified salt reduction program for selected portions of Routes 128, 2, and 2A. Although the impact study only concentrates on the Hobbs Brook Reservoir, the Department felt it appropriate to broaden the scope of this program to include the Stony Brook Reservoir area as well. The designated test area included the following highways and interchanges (lane miles listed below do not include ramps within the interchanges):

A section of Route 128, (I-95) (68.6 lane miles) from the River Street bridge (Overpass) in Weston northerly to a point five hundred feet north of the Route 2A interchange in Lexington.

Route 20 - 0.9 linear mile (2.7 lane miles) westerly, 0.6 linear mile easterly (2.4 lane miles).

Route 2 - 1.85 linear miles westerly (7.4 lane miles), 1.45 linear miles easterly (11.6 lane miles).

Route 2A - 1.0 linear mile westerly (2.0 lane miles), 0.5 linear mile easterly (1.0 lane mile).

Over the 1986-1987 winter, this area experienced a total of twenty storm conditions. Fourteen ranged from trace amounts to three inches, five storms ranged from three to six inches and one storm from six to nine inches in accumulation.

The test materials were applied to a road surface of "Type-I" bituminous concrete. The average roadway in the study area consists of four travel lanes and one breakdown lane in each direction. Ninety-nine percent of the test area drainage operates on a catch basin system. The remainder is country drainage. The average daily traffic volume measured in the Weston portion of the test area is 157,070 vehicles.

The material applied to the test section area was a commercially produced material called "Pre-Mix". Pre-Mix is composed of four parts sodium chloride to one part calcium chloride by weight. During the first major snowstorm, Pre-Mix was applied directly to designated roadways. For all subsequent storms, dry sand was added at a ratio of one part Pre-Mix to one part sand by volume. There were two reasons for the addition of sand. First, the calcium chloride contained in the Pre-Mix had on occasion, in past practice, produced a road surface that was "greasy" and that adversely affected the movement of traffic. This could not be tolerated on these high speed, high volume roadways. Therefore, sand was blended with the Pre-Mix in order to provide immediate traction. The second reason was to attempt to hold the Pre-Mix on the road surface for a greater period of time, counteracting the tendency of vehicles to whip the material off to the roadsides. In practice, the program using this Pre-Mix and dry sand mixture proved successful, reducing the number of times the Pre-Mix needed to be re-applied.

Material spreaders, state-owned and hired, used in the test area, were hydraulically driven with in-cab adjustable controls with ground-speed sensors. During the first storm of the season straight Pre-Mix was applied at a rate of 300 pounds per lane mile. In subsequent storms where the material applied was a mixture of one part Pre-Mix and one part sand by volume, the application rate was 400 pounds per lane mile of the Pre-Mix and sand mixture. Ramps and interchanges were treated with the same mix at twice the application rate. The rates applied varied according to the calibration of the machinery which was able to dispense material within 10% of the prescribed rates. Computer card monitoring was used to control specified time and quantities of Pre-Mix and dry sand applied to the road surface.

The average combined application rate for the entire winter for all ramps and travel lanes, as indicated by this monitoring system, was 687 pounds of the Pre-Mix/sand mixture per lane mile.

This figure appears high and suggests a greater rate of sodium chloride application than there would be using the Department's standard policy. However, this is not true, because the two materials were mixed by volume, and the sand is much heavier than Pre-Mix. Therefore, the ratio by weight will indicate that the amount of Pre-Mix used is considerably less than an application of straight salt at 300 pounds per lane mile. Furthermore, the total amount of Pre-Mix applied is known to be precisely 1,552 tons. In addition, the overall season-long application rate is affected by the number of applications necessary, the types of weather conditions through the winter, and higher application rate on ramps.

Plowing of treated snow commenced when the depth exceeded two inches. Plowing was stressed in order to reduce the number of material applications. The frequency of reapplication in this section was determined by an engineer assigned to direct the study.

Material was stored in the Weston depot during the fall. Since the lane miles treated (including ramps and interchanges) was a total of 112.56, this depot was dedicated solely to the winter maintenance of the roadways included in the experiment. Two material storage buildings were utilized on this project, one for the Pre-Mix and the other for storage of dry sand. It was necessary to store sand inside, because it must be absolutely dry in order to mix it. This meant that the experiment required double storage capacity to provide dry storage for both sand and Pre-Mix. Any material remaining from the prior winter had to be transferred to another section.

Pre-Mix was delivered to the test section maintenance depot at a cost of $73.56 per ton. The cost of the dry sand used in the experiment was $6.50 per ton delivered. The total amount of Pre-Mix used for the 1986-1987 season was 1,552 tons. Multiplying the tons used by the cost per ton of $73.56 gives a cost for Pre-Mix of $114,165. Eleven hundred (1,100) tons of sand was mixed with the Pre-Mix for a cost of $7,150 at $6.50 per ton. Therefore, the total cost of materials for the experimental section was $121,315.

In order to make a reasonable cost comparison, it is necessary to arrive at an estimate of the cost of materials for the test section if straight salt had been used. One method is to compare current salt use with previous years. The difficulty with this is that this same 112.56 lane miles was not treated as a unit in previous years, and it cannot be broken out from the maintenance section in which it is located with complete accuracy. Also, storm conditions vary significantly from year to

year, so that a comparison of usage within the same year gives a more reliable result. Therefore, the method selected is a comparison between the test section salt usage during 1986-1987 and salt usage for the remainder of the highway maintenance foremen's sections (sections 6 and 7) which cover Route 128 and the other major state highways in Lexington, Reading, Weston, and Concord. This is valid, because the geographical area involved had the same or similar storm conditions in 1986-1987 as the test area and those sections contain sufficient high volume and high speed roads to allow a reasonable comparison. The application rate for the winter for the remainder of sections 6 and 7 was 28.55 tons per lane mile. Multiplying this figure by 112.56 lane miles in the test area provides an estimate that a total of 3,214 tons of salt would have been used in the test section had there been no low salt experiment. At $23.35 per ton, straight salt application would have cost the Department $75,047. Therefore, material costs for the experiment were greater than the estimated cost without the experiment by $46,268 ($121,315 - $75,047).

In addition to the extra cost of materials, there was a cost for removing sand from the highway and drainage structures. Catch basin and shoulder cleanup is a problem that is not associated with use of straight salt, because there is no residue on the surface. Removing the sand was important on Route 128, because the numerous drainage structures and bermed (enclosed) roadway edges prevent the sand from migrating off the roadway. Removal is estimated at $40.00 per ton of sand applied. Using this figure for removal of the 1,552 tons of sand, the additional cost of cleanup is $62,080.

All twenty storms experienced over the 1986-1987 winter season required an average of eight material spreaders which were paid at a rate of $41.00 per hour. Spreading sand and Pre-Mix on this section took approximately three hours longer than it normally would have taken to spread straight salt. The three hour figure is an estimate based on observation in the field by experienced personnel. The additional cost incurred was $19,680. This figure is derived by multiplying twenty storms times the eight spreaders that are normally used times the three additional hours for each spreader times the cost per hour of $41.00.

Six of the twenty storms required the use of plows. During these six storms, an average of thirteen plows were needed for the test section. The cost was an average of $40.50 per hour per plow. Again, it took an estimated four hours longer per storm to clear the roadway than would be expected if straight salt had been used. This figure multiplied by the extended period of four hours equals $12,636 for additional cost for plows. Therefore, the total additional hired equipment cost was

$32,316. The aggregate cost for this project, excluding any additional capital costs, above the normal annual winter maintenance expenditure for this area, is estimated at $140,664 for the year.

As shown in the charts in Appendix A, the District was able to maintain a serviceable roadway in the test area by applying only 1,551.61 tons of Pre-Mix to this test section for the entire winter. The total application of sodium chloride in the test area was 1,241.28 tons or 11.03 tons per lane mile. This compares favorably to the 28.55 tons per lane mile applied during the same time period in the remainder of the maintenance section. Thus, the one to one application of Pre-Mix and sand in the Cambridge watershed test area resulted in a sixty-one percent (61%) reduction in the quantity of sodium chloride applied to the test area.

The safety of the travelling public was the highest priority during the experimental winter season. It is considered important to maintain a road condition that is not significantly different from that in adjacent sections of roadway. If drivers encounter snow pack or ice in a section of road next to sections that are clear, they may have difficulty adjusting rapidly enough to avoid accidents. The engineer in charge during the course of the winter attempted to keep precipitant in a pliable or mealy condition in order to minimize the number of reapplications of deicing materials. This required careful and constant monitoring of road conditions. Observations indicated that it took from two to four hours longer than adjacent non-test sections for the test section to return to bare pavement after a storm. Therefore, the test area did present the motorist with different pavement conditions when travelling from the non-test roadway into the test section. The test sections could be safely negotiated at reduced speeds below 40 miles per hour, but some traffic problems and delays occurred in and near the test area during storm periods. Accident data for this section of Route 128 from October to May during icy and snow covered conditions are in Appendix B. There was an increase from five accidents in 1985-86 to ten in 1986-87.

In conclusion, it appears from all the data provided, that this salt reduction program was successful in achieving the objective of reducing application of sodium chloride, but only with some sacrifice in level of service to the public. The study produced a 61% reduction in the total amount of sodium chloride applied in comparison to adjacent areas. The success of this program in attaining this sodium reduction was primarily due to the ability to dedicate key supervisory personnel specifically to control the winter operations in the confined test area. Route 128 is a high speed and high traffic volume highway which

requires careful monitoring and a high level of snow and ice control expertise to keep traffic flowing smoothly and safely. The Department was fortunate to have that expertise available in District 4 for the Route 128 experiment. It is recommended that the Department implement the use of Pre-Mix in areas already selected for reduced sodium chloride treatment, but that any new high speed and high volume roadway area be thoroughly reviewed for feasibility before expanding the program into new low-salt test locations.

III. CAPE COD

The salt reduction program on Cape Cod was specifically requested by DEQE, local environmental organizations, and the local communities. Water is provided to Cape Cod by a sole source aquifer. With only the one main source of drinking water for the entire area, the issue of water quality is very sensitive. The aquifer is overburdened by increases in both year around and seasonal populations. It is also subject to contamination by any number of commercial, industrial, and municipal activities, not connected with state highway deicing programs. Public opinion has generally been that a reduction of salt applications would be a beneficial contribution to efforts to maintain or improve the water quality on Cape Cod.

The Department of Public Works responded by setting up a two-pronged salt reduction experiment. The first of the two salt reduction projects covered the Mid-Cape Highway (Route 6) from the Cape Cod Canal to Orleans Rotary and Route 28 from the Canal to Falmouth at the end of the State Highway. The average daily traffic volume for Route 28 from the Bourne Bridge in 1986 was 26,364. The other major roadway in the test area, Route 6, measured from the Sagamore Bridge, had an average daily traffic volume of 35,614 in 1986. The deicing material applied to these highways consisted of one part salt to one part sand.

The second test covered all other state highways east of the Cape Cod Canal. These test roads are known to carry primarily local traffic at lower speeds. These roads were treated with a mixture of one part salt to four parts sand.

Sodium chloride provided to depots in both test areas was furnished and delivered by International Salt Company at a cost of $27.34 per ton. Local vendors supplied dry sand at an average cost of $4.69 per ton. This material was applied to a road surface of "Type-I" Bituminous concrete. The average road width for the test area varied between 24 and 48 feet, four travel lanes

plus one breakdown lane in each direction. Approximately 95% of the test area's drainage relies upon a catch basin system. The other 5% is country drainage, in which the highway runoff drains off the roadway over the embankments without being channelled into conduits or drainage structures.

The deicing material was dispersed on designated roadway surfaces by state-owned and hired spreaders. These spreaders were hydraulically driven with in-cab controls with ground speed sensors. The rate of total material application in both test areas was prescribed at 300 pounds per lane mile. This rate was to remain constant throughout the duration of the 1986-1987 winter season. Reapplication of materials was determined by engineers and foremen overseeing these test projects. The Department's Material Control System indicated that in the early stages of the season these routes received material applications in excess of the predetermined application rate of 300 pounds per lane mile. This problem was soon rectified by adjusting material spreaders to the proper rate of distribution. The misapplication of material during this period was adjusted early enough so that the intended goals of these studies were not adversely affected.

In order to avoid excess application of materials on the four-to-one roadways, applications were made only when material was dispersed on the one-to-one roadways. This was in accordance with the approved policy set by a vote of the Public Works Commission. This procedure was followed except when packed conditions developed. At those times the following steps were taken:

1) Plowing continued until it became ineffective.

2) Material was applied to the packed roadway prior to leaving the section until the next day's application began.

3) If calls were received during off-duty hours, the foreman reapplied one application of the approved material mix.

4) If no calls were received, the foreman would go out at 3 or 4 a.m. and check his assigned roadways. If he felt a hazardous condition existed, he would reapply one application of the material in an attempt to provide a safe travel surface for morning commuters.

5) If the packed areas became plowable, steps 1-4 listed above were repeated until all packed areas were cleared.

It should be noted that the 1986-1987 snow season was the most severe that the Cape Cod area has experienced in almost fifty (50) years. Twenty-two (22) storms occurred, resulting in a total snowfall of approximately sixty-two (62) inches (compared with a ten-year mean of twenty-six (26) inches), and wind gusts of up to eighty (80) miles per hour.

During the first several storms of the season, there appeared to be no appreciable difference in roadway conditions between the one-to-one and four-to-one areas. However, after reviewing the printouts of the Material Control System it was found that the routes were being treated at rates much greater than the prescribed application rate of 300 pounds per lane mile, and also many of the two-lane routes involved were being treated once in each direction. These discrepancies were brought to the attention of the foremen as they were discovered and at a meeting on February 3, 1987. The importance of compliance with the approved policy was emphasized. These problems were slowly corrected by the foremen until field checks showed that most spreaders were in compliance within reasonable tolerances.

During the first five snow storms on the Cape (November 19, 1986 - January 19, 1987) the temperature ranged from 30 to 34 degrees. At these temperatures there was no visible difference between the four-to-one and one-to-one roadways, and all surfaces became clear quite rapidly at the conclusions of the storms. During the next eight storms varying amounts and depths of pack began to form. The pack generally disappeared from three to four hours after the storm. However, in the case of the storm of February 9 and 10, 1987, the pack condition remained for eight or nine days after the storm. The pack on roads treated with one-to-one mixtures did breakup somewhat faster than those treated with four-to-one mixtures, but in order to completely clear the roads, continual plowing and prudent reapplications of material were required as previously outlined.

The charts in Appendix F set out the lane miles, snow and ice conditions, and tons of sodium chloride used in the four maintenance sections of Cape Cod. The average reduction in salt use across the sections is 67 percent below the average usage from the four previous winters.

The reduced salt applications resulted in extra costs (excluding the blizzard of February 9 and 10) of approximately $38,136 for equipment and personnel only. The estimate is derived by the following calculations:

1) Twenty-four Spreaders and Loaders Average, 4± hours more per storm, $37.00 per hour, 4 storms.

24 X 4 X 37 X 4 = $14,208

2) Forty Plows Average, 4± hours more per storm, Average $35.00 per hour, 3 storms.

40 X 4 X 35 X 3 = $16,800

3) State personnel 33± employees, 4± hours more per storm $13.50 per hour, 4 storms.

33 X 4 X 13.50 X 4 = $7,128

$14,208	Sanders
16,800	Plows
7,128	State Personnel
$38,136	

The additional costs, as in the Route 128 equipment usage figures, relate to the longer time period required to complete snow and ice removal operations when using less effective deicing materials. In this experiment the additional time estimate of four hours for all operations is based on observations on the job by experienced engineers.

The Department, through this experiment, realized a savings of 5,296 tons of sodium chloride as compared to the total salt applied on Cape Cod averaged over the prior four years. This savings multiplied by the average cost of sodium chloride on the Cape of $27.34 per ton yielded a savings of $147,991. In order to achieve this reduction of sodium chloride, the Department required more extensive spreading of sand in its winter maintenance operations. Sand usage increased by 100%, going from a four year previous average of 5,285 tons to 10,581 tons applied this past season. This increase of 5,296 tons multiplied by the average cost of $4.69 per ton yields an increase of $24,838. Therefore, the total savings on deicing materials for Cape Cod as compared with an average taken for the past four seasons equals $123,153.

There appears to be no additional cost related to clearing away the buildup of sand on the roadways. The reason for this is that there are few catch-basins in this test area, allowing the sand to move off the roadway into the grass areas adjacent to the travel lanes. There were, however, other costs which cannot be

measured in dollars and cents. The experiment was more stressful to employees in the field. This stress was caused by the extra long hours and by the increased tension which the employees experienced due to poor road conditions.

The district personnel who were implementing the experiment made the following observations concerning the effectiveness of the mixture in snow and ice control:

1) The 4-1 mixture is totally inadequate in preventing packed snow from forming on the pavement when the temperature falls below $28 \pm {}^{\circ}F$.

2) The 1-1 mixture is more effective in preventing the formation of pack down to $25 \pm {}^{\circ}F$.

3) The wind plays a key role in forming and maintaining an adequate brine solution on the pavement. (Wind tends to evaporate the brine, requiring more frequent material applications.)

4) Higher traffic volume decreased the formation and duration of the pack.

5) At times it was very useful to apply straight sand to the roadways for better traction, because the applied mixtures failed to function adequately below 28° Fahrenheit.

Public opinion was an important consideration in the experiments on Cape Cod. It was generally favorable prior to the major storm in February. After this storm, however, public sentiment shifted to a feeling that the low salt policy is good in theory, but that there should be some flexibility to deal with emergency situations. This is reflected in the findings of a meeting of the Road Salt Task Force, a community group, held in Barnstable on February 26, 1987, which was attended by the District Highway Engineer and District Liaison Coordinator. The Task Force adopted the following position:

a) A more aggressive public information campaign should be initiated.

b) It would be almost impossible to change the policy to respond to emergency situations. However, a <u>first</u> application of 100% salt on the Mid-Cape and Route 28 from Bourne to Falmouth would be acceptable.

c) The Cape would like to keep the 4-1 policy but with emergency provisions.

d) Feedback during the past few months has been positive. Several people from all areas of the Cape have commented on the policy and how it has been communicated to the public. The general feeling is that the Department did a fine job in reporting road conditions and that it will take a while before people really hear what we are saying.

A more complete report of the public opinion aspects of the experiment is contained in Appendix E.

The program as instituted on Cape Cod was successful from the standpoint of providing a sodium chloride reduction of 67% as compared to the past four years. However, as previously indicated, at temperatures below 28 degrees and 25 degrees, respectively, the four-to-one and one-to-one sand-salt mixtures were ineffective in preventing the motor vehicle traffic from packing the precipitant on the pavement. Once the bond between the precipitant and the road surface occurred, the only method allowable under this policy to remove the pack, was the continual scraping with plows along with material reapplication. In effect, the warming temperatures and radiant heat of the sun acted as a catalyst in removing this pack when it occurred. If this policy continues unchanged, the packed situation may be better handled with the usage of heavier equipment. This is not readily available for hire from the private sector on Cape Cod, and the Department would be required to purchase and dedicate this equipment to that area.

When the pack started breaking, particularly following the February 9, 1987 storm, segments of various roadways cleared faster than others. Drivers, seeing this clearing, tended to accelerate and could not slow safely in time when they next encountered portions of highway where pack had not yet dissolved. Although traffic statistics on accidents were not collected for Cape Cod as part of this initiative, the commuter roads, Routes 6 and 28, had numerous multicar accidents for the week that the pack persisted following the February 9 storm. These accidents were observed by Department personnel or reported to the Department by local police. Secondary roadways also had pack but accidents were few due to the low travel speeds and lower traffic volumes.

Upon review of the news clips in Appendix E provided by the District, it is apparent that the residents, local conservation commissions, and other related organizations want this program to continue. There are many, however, who want this program modified with an allowance for straight salt applications when needed. On the other hand, if given such leeway, the foremen and

engineers would approve use of straight sodium chloride at the first indication of a hazardous condition in an effort to maintain the safest road conditions. This would compromise the program's intended purpose.

If this salt reduction program is to be carried over for the next winter season, which is the recommendation of the Maintenance Division, it is apparent that a different mixture will be required that will work at lower temperatures. Given the successful results of the Pre-Mix and sand mixture as demonstrated in the winter maintenance program of District 4 in the Cambridge Reservoir area, it appears feasible to use this material in the ratios approved for Cape Cod for last season. It would be ideal to introduce both sand and salt mixtures at higher temperatures and Pre-Mix sand mixtures at lower temperatures on the Cape. It must be noted, however, that environmentally sound covered storage is limited on Cape Cod. Therefore, it will be necessary to apply the same mixture on all roadways.

Therefore, it is recommended that this program be modified next season with the use of Pre-Mix in place of sodium chloride. However, in the District's gang 10A on Cape Cod, the Department stores approximately 350 tons of sodium chloride without permanent cover on land it leases from the Cape Cod National Seashore. There has been no land available that the Department is capable of acquiring for a Maintenance Depot, and the Department has been forced to store its deicing materials on a bituminous concrete pad covered with polyethylene, a less than satisfactory method of operation. Pre-Mix, if stored in this manner, would absorb moisture and solidify to the point of being unusable over the course of the winter. Due to this situation, the Maintenance Division recommends carrying over the same low-salt procedure (salt and not Pre-Mix) as last winter for the areas gang 10A cares for, which is all state highways through the municipalities of Wellfleet, Truro, and Provincetown.

IV. Low Salt Areas in the Vicinity of Municipal Water Supplies

The third area under examination during the winter season of 1986-1987 was reduced salt areas in the vicinity of municipal water supplies. This study was planned in conjunction with DEQE. The Department of Public Works designed a uniform program in an attempt to reduce the total amount of sodium chloride applied in selected areas. These locations, designated by the Department and DEQE as "salt sensitive" highways, were treated with material applications composed of substantially reduced levels of sodium chloride by volume.

Material which was applied in the test area was comprised of a mixture of one part dry sand to one part sodium chloride. The exceptions to this application rate were certain roadways in Goshen, Pelham, Belchertown, and Cummington. Goshen has been in the reduced salt experiment program since the 1984 - 1985 winter season. Pelham, Belchertown and Cummington were added in the winter of 1985-1986. These areas were treated primarily with a mixture of three parts sand to one part sodium chloride and a mixture of four parts sand to one parts sodium chloride, if conditions allowed.

Material spreaders for the municipal water experiments were both state-owned and hired and were hydraulically driven with in-cab adjustable controls with ground speed sensors. The rate of application was regulated by computer card monitoring, allowing the Districts to track time and quantities of sand and sodium chloride applied. The rate that material was dispersed was set at 300 pounds per lane mile. Subsequent material reapplication was dictated by test engineers as conditions warranted. Plowing of treated snow commenced as levels of snow depth exceeded two to three inches.

Accident reports are not available for most of the test areas. However, the description below includes a discussion of road conditions which illustrates the level of service to the public. Accident report analysis is discussed in those places where it is available.

Sodium chloride was furnished to test area depots at an average cost of $28.33 per ton. Sand was provided to test area depots at an average cost of $4.77 per ton. The majority of test locations show that significantly less sodium chloride was used, in comparison to the average quantity applied per lane mile district-wide. The resulting decrease in cost was generally offset by an increase in cost of equipment usage.

District 2:

Belchertown - Pelham

location: Route 202

length: 15.2 lane miles

road surface: "Type - I" Bituminous Concrete

average road width: 28.00 feet

lanes: 2 travel lanes, 2 breakdown lanes

drainage: open drainage system

ADT: 1,221 vehicles

tons of salt per lane mile applied in test area: 2.5

tons of salt per lane mile applied district wide: 13.04

percent difference: 81% reduction

Reports submitted by test area foremen provided little information regarding the effectiveness of the test material on the designated test roadways. In two instances severe pack developed on test surfaces. Considerable snow accumulation appeared to play a significant role in the development of this pack, because temperature in this area was variable during these particular storms. Gauging the overall effectiveness of the test material at low temperatures was difficult due to a lack of substantive comments in the foremen's reports. The foremen's reports included descriptions of pavement conditions during numerous storm periods with temperatures ranging from 24 degrees Fahrenheit to 37 degrees Fahrenheit, and at those temperatures the test material demonstrated effectiveness as a deicing agent.

Granby

location: Route 202, South Hadley town line

length: 14.9 lane miles

road surface: "Type - I" Bituminous concrete

average road width: 32.00 feet

lanes: 2 travel, 2 breakdown

drainage: catch basin system

ADT: 8,270

tons per lane mile applied in test area: 5.95

tons per lane mile applied District wide: 13.04

percent difference: 54% reduction

Reports as submitted by the foremen in the test area indicated that the test material was effective in providing a safe travel surface to motorists during storm conditions in which temperatures were above 30 degrees Fahrenheit. However, in storms where temperatures remained at or below 30 degrees Fahrenheit, roadway travel conditions became hazardous as pack developed and persisted. Under these conditions it became necessary for foremen to recommend reapplication of deicing material.

Orange

location: Route 2, from ½ mile east of Wendell Depot Bridge to ½ mile west of Route 122

length: 12.9 lane miles

road surface: "Type - I" Bituminous concrete

average road width: 40 feet

lanes: 2 travel, 2 breakdown

drainage: catch basin system

ADT: 7,100 vehicles

tons per lane mile applied in test area: 5.09

tons per lane mile applied District wide: 13.04

percent difference: 61% reduction

Reports submitted by test area foremen indicated that test materials applied to roadway surfaces functioned as an effective deicing agent at temperatures in excess of 30 to 32 degrees Fahrenheit. The effectiveness of the test material as a deicing agent on the same roadway surfaces decreased greatly during storm conditions with temperatures at or below 30 degrees Fahrenheit. Reduced temperatures, in effect, neutralized the effectiveness of the test material and allowed a pack to develop. The result of this buildup was that the road was occasionally plowed in lieu of material applications. There was a notable reduction in traffic speeds.

Goshen

location: Route 9

length: 4.2 lane miles

road surface: Verglimit

average road width: 28 to 40 feet

lanes: 2 travel, 2 breakdown

drainage: closed drainage system

ADT: 3,507 vehicles

tons per lane mile applied in test area: 1.73

tons per lane mile applied District wide: 13.04

percent difference: 87% reduction

Goshen differs from the other test sections in that the road surface is a relatively new product that helps in deicing. The Verglimit surface contains calcium chloride, which washes out of the pavement and prevents the buildup of snow packs. Section VII of this report describes the surface and its effectiveness.

Reports as submitted by the foremen in the test area indicated that the salt/sand mixture was an effective deicing agent on test area surfaces. On fifteen of sixteen occasions in which storm conditions were recorded in the test area, and where temperatures ranged between 14 degrees Fahrenheit and 36 degrees Fahrenheit, the test material was effective in providing a safe travel surface to highway motorists. There is only one account of snow pack on test area surfaces. This occurred as the result of a heavy snow accumulation combined with storm temperatures of 28 to 32 degrees Fahrenheit.

Cummington

location: Route 9, from the west end of Dudley Mannor Bridge to Main Street

length: 2.37 lane miles

road surface: "Type I" Bituminous concrete

average road width: 40 feet

lanes: 2 travel, 2 breakdown

drainage: closed drainage

ADT: 2,747 vehicles

tons per lane mile applied in test area: 1.08

tons per lane mile applied District wide: 13.04

percent difference: 92% reduction

In the reports which were submitted by test area foremen, the findings were identical to those on the Route 9 Goshen test section. In fifteen of sixteen instances in which storm conditions were experienced with temperatures ranging between 14 and 36 degrees Fahrenheit, the test material was effective in maintaining safe roadway travel conditions. On only one occasion did the road surfaces develop severe travel conditions. This was a result of a heavy snow accumulation combined with temperatures ranging beween 28 and 32 degrees Fahrenheit. The test material generally appeared to work effectively and reliably as a deicing agent on the Cummington test area.

Belchertown

location: Route 9

length: 13.9 lane miles

road surface: "Type I" Bituminous concrete

average road width: 26 to 40 feet

lanes: 2 travel, 2 breakdown

drainage: both open and closed drainage

ADT: 5,111 vehicles

tons per lane mile applied in test area: 2.41

tons per lane mile applied District wide: 13.04

pecent difference: 82% reduction

Reports as submitted by the test area foremen indicated that the test material was effective as a deicing agent in nine of the ten storms. These storms had temperatures ranging from 20 to 37 degrees Fahrenheit. In the single instance where the test material was unsuitable as a deicing agent, low temperatures, low traffic volume, and heavy snow fall all played considerable roles in the development of compacted snow and treacherous driving conditions. Aside from this and occasional slick road surfaces, the overall view of the test material was positive.

District 3:

Athol

location: Route 2A

length: 6.3 lane miles

road surface: "Type I" Bituminous concrete

average road width: 40 feet

lanes: 2 travel, 2 breakdown

drainage: catch basin system

ADT: not available

tons per lane mile applied in test area: 15.97

tons per lane mile applied District wide: 20.71

percent difference: 23% reduction

Athol was not included in the original vote of the Board of Commissioners. However, the District voluntarily participated in this program in response to local concerns regarding water quality.

Reports submitted by the test area foreman indicated in the nine instances in which storm conditions existed in the test area with temperatures between 20 degrees and 30 degrees Fahrenheit, the test material provided a safe travel surface. On only one occasion did a compacted snow bond develop. This was during a storm in which the average temperature was 12 degreeś Fahrenheit.

Boylston

location: Route 70, north of Route 140

length: 4.8 lane miles

road surface: "Type I" Bituminous concrete

average road width: 25 feet

lanes: 2 travel, 2 breakdown

drainage: both catch basins and country drainage

ADT: 9,721 vehicles

tons per lane mile applied in test area: 15.72

tons per lane mile applied District wide: 20.71

percent difference: 24% reduction

Reports as submitted by the test area foreman consistently stated unfavorable results regarding the effectiveness of the test material as deicing agent. In all of the storm logs the foreman noted continuous problems with the test material where temperatures ranged from 24 degrees Faharenheit to 30 degrees Fahrenheit. Packed snow and slippery travel surfaces resulted in occasional skidding accidents according to Boylston police reports. This condition persisted despite continued reapplications of material to test area surfaces. Many reapplications were requested by the Boylston Police Department, citing unsafe travel conditions and slippery road surfaces.

Auburn

location: Route 12 from Route 20 to the Worcester - Auburn town line and from Old Worcester Road to Route 20

length: 27.7 lane miles

road surface: "Type-I" Bituminous concrete

average road width: 40 feet

lanes: 2 travel lanes

drainage: catch basins

ADT: 7,427 to 11,050 vehicles

tons per lane mile applied in test area: 21.76

tons per lane mile applied District wide: 20.71

percent difference: 5% increase

Originally a 15.2 mile stretch of road around the Auburn water well field at Route 12 and Church Street in Auburn was considered for this salt reduction project. Due to logistical difficulty, the District decided to extend the area on Route 12 beginning at Routes 12 and 20 in Auburn and ending at the Worcester - Auburn town line. Also, because of a number of complaints the District received from the Oxford Water Department, a section of Route 12 from the junction of old Worcester Road to the intersection with Route 20 was included.

Reports as submitted by test area foremen for Auburn indicated that the test material was ineffective in providing a safe travel surface to motorists during the storm conditions that were monitored. The temperatures ranged from 22 degrees to 26 degrees Fahrenheit. Area foremen supervising this project ordered reapplication of test material in response to pack development and reports of skidding accidents by the local police department. The Auburn Police Department initiated many reapplications of material in response to calls regarding unsafe roadway conditions.

District 4

North Reading

location: Route 28, from the Essex-Middlesex County line to a point beyond the Saugus River

length: 9.17 lane miles

road surface: "Type-I" Bituminous concrete

average road width: 44 feet

lanes: 2 travel, 2 breakdown

drainage: catch basins

ADT: 15,150 vehicles

tons per lane mile applied in test area: 20.89

tons per lane mile applied District wide: 22.04

percent difference: 5% decrease

The foreman's report for North Reading suggests that the test material had a variable effectiveness. For the most part, in storm conditions with temperatures above 31 degrees Fahrenheit the test material applied to these roadway surfaces provided a safe travel surface to motorists. In storm conditions which maintained an average temperature below 31 degrees, the effectiveness of the material as a deicing agent was lacking. Under these conditions, pack developed on road surfaces resulting in reduced traffic speeds and an increase in vehicular accidents. In an attempt to combat treacherous travelling conditions, considerable increases in plowing as well as increases in material reapplications were required. The application figures reflect a notable increase in the amount of sodium chloride applied to this area due to excessive reapplication of the test material. This was done in an attempt to provide the area with safe travelling conditions and in response to police call backs to treat dangerous conditions.

Accident data for this area showed a significant increase in accidents involving motor vehicles for the winter months, October through May. The number of accidents increased from last year's figure of nine to a total of fifteen accidents this year. This represents a 66% increase in the number of accidents.

District 6

Avon

location: Harrison Boulevard from Route 24 to Route 28

length: 4.52 lane miles

road surface: "Type-I" Bituminous concrete

average road width: 40 to 45 feet

lanes: 2 travel, 2 breakdown

drainage: catch basins

ADT: 14,700 to 20,800 vehicles

tons per lane mile applied in test area: 22

tons per lane mile applied District wide: 25.81

percent difference: 15% reduction

The foreman's reports were critical in assessing the effectiveness of the test material as a deicing compound. In storm conditions with temperatures ranging from 13 degrees to 29 degrees Fahrenheit, roadway surfaces in the test area consistently experienced unfavorable travel conditions. This area had a general decrease in traffic speeds due to packed snow and ruts on the test roads as well as a slippery travel surface.

Accident reports for the months of October through May show no increase in the number of motor vehicle accidents over the past year. There were two accidents attributed to road conditions in the past two years, showing no real effect on the number of accidents which occurred.

District 7

Abington/Rockland

location: Route 123 and Route 18

length: 18.75 lane miles

road surface: "Type-I" Bituminous concrete

average road width: 30 feet

lanes: 2 travel, 2 breakdown

drainage: both catch basins and country drainage

ADT: 9,900 to 17,500 vehicles

tons per lane mile applied in test area: 21.55

tons per lane mile applied District wide: 19.45

percent difference: 11% increase

During the first part of the season there appeared to be no appreciable difference in roadway conditions between the reduced salt areas and abutting roadways. However, after reviewing the printouts of the Material Control System, it was found that the routes were being treated at rates much greater than the prescribed application rate of 300 pounds per lane mile. In addition, the routes involved were only two lanes, and they were being treated once in each direction. This problem was addressed at a meeting of the foremen on February 3, 1987. Thereafter, computer printouts began to show some reduction in the application rate of the spreaders. Unfortunately, due to the lack of an assigned monitor the application rate of the one-to-one sand/salt mixture was never brought down to the 300 pounds per lane mile.

With the understanding that application rates were high, frequent favorable comments regarding the effectiveness of the test material is not difficult to understand. This was the case for all of the storms where temperatures ranged between 25 degrees and 33 degrees Fahrenheit. Although it was noted by the test area foreman that as temperatures dropped below 25 degrees Fahrenheit, some pack developed.

Summary of Results for Low Salt Areas in the Vicinity of Municipal Water Supplies: It appears after analyzing the available data on this initiative that this program had a significant impact on the vehicular traffic traversing the test area roadways. Although the roadways included in this study were all classified as secondary in nature, they were affected less on the more rural, lower ADT roadways than on the more urban, higher ADT roadways. Temperature played a major role in the reaction of the mix used to deice these roadways. It appears that the useful range of this mixture, that is when there was relatively minor effect on the flow of traffic, was about 29 degrees Fahrenheit and higher. More frequent applications were required to keep the precipitant plowable, unlike adjacent areas using the Department Standard Application Rate of straight sodium chloride applied at 300 pounds per lane mile. It further appears that in the 25 degree Fahrenheit range and lower most areas began to experience packed snow. This last statement is a generalization as packed snow on pavement is a factor of temperature, rate of precipitation, and traffic volume. All areas required more frequent plowing than adjacent areas and appeared to take longer to return to a clear, black pavement. Cost analysis was not undertaken as part of this project. Due to the limited scope it was not felt that there would be a signficant difference in cost.

Most areas were able to show a reduction in the total amount of sodium chloride applied. Again, the areas with the largest

reduction were the secondary roadways having the lower ADT. The areas that applied more sodium chloride were the higher ADT, urban area roads. Apparently, the traffic in the rural areas can bear a reduced level of service of the roadway that differs from adjoining state highways, while more material had to be used to keep the urban traffic flowing. A good deal of the material applied in the areas that were close to or exceeded the District wide application rate was due to repeated calls by public safety officials for more application of materials. In such instances the area foremen have no choice but to respond.

Total responsibility for the increases in salt use in Auburn, North Reading, and Abington cannot be attributed to police agencies. The Department in setting this program in motion in these towns selected segments of roadways that were not complete routes covered by one spreader. A successful low salt operation is only possible with one-spreader routes, because the special low salt mixture has to have its own dedicated spreader. It is impossible to use the same spreader for both straight salt and salt/sand mixes. Furthermore, the area foremen have long been trained to not allow traffic to become affected during storm conditions. Although training sessions were held last fall by Department personnel to acquaint them with this program, some confusion still existed. The reports show that the perception of the individual foremen differ regarding what is a safe level of service and how easy or difficult it was to work with the material. The idea of a pavement that was not clear and black immediately following a storm condition was not readily acceptable to most of these foremen, and it took several storms before the policy change became clear.

The major factor that still remains to be changed is the motoring public's driving habits during storm conditions. In every area the Department undertook extensive public information campaigns to publicize the new policies and had road signing in place alerting people to the changes prior to the winter. Even so, the public still retained speeds as if no storm were occurring. It is the opinion of the Department that in every test location a safe driving surface was maintained, as long as reasonable speeds were maintained by the motorists as warranted by the storm condition.

Based upon the results of these experiments, it is recommended that this program be continued next season. Although the salt reduction program for the 1986-87 winter season was not a total success in meeting its intended goals, the results justify extending the experiment for another season. The Department personnel involved in this experiment have discovered the problems associated with this program now and will take steps to reduce the

effect on traffic while reducing the amount of sodium chloride applied.

It is recommended that the Districts increase the lengths of the test areas to make full utilization of one spreader for each of the areas. This will help in the monitoring, as well as insure that material is placed at the rates prescribed. It is also recommended that Pre-Mix, four parts sodium chloride to one part calcium chloride, be used in place of salt in the one-to-one mix. This will provide an immediate 20% reduction in the amount of sodium chloride applied. It is hoped that the Pre-Mix, which reacts at temperatures much lower than salt, will reduce the number of reapplications required because of temperature drops and will also reduce the incidence of pack. With these corrections in place next season, the policy should reduce sodium chloride near water supplies and succeed in its goal of maintaining a satisfactory level of service to the public.

V. Reduced Salt Applications on Low Volume Secondary Roadways

The Department's winter maintenance program was the focus of a hearing in the spring of 1986 held by the Special Legislative Commission on Water Supply. This committee, chaired by Representative Jonathan L. Healy and Senator Carol C. Amick, criticized the Department for its standard sodium chloride application rate set uniformly at 300 lbs per lane mile per application for all state highways. The committee cited other states in which written policies indicate rates which varied for differing classifications of roadways, such as interstate, primary, secondary, and rural.

As a result of these hearings, the Department investigated the feasibility of treating selected secondary roadways with a 50% reduction in the amount of sodium chloride per application using a 50-50 sand-salt mixture. The eight districts were requested, if possible, to designate one or more roadways in this manner for the 1986-1987 winter. The attached Board of Commissioners' vote (figure 1) lists the areas that were selected for experimentation.

The composition of material applied to test sections was made up of one part dry sand to one part salt. This was applied in each of the test locations to a road surface of "Type-I" Bituminous concrete. Chemical spreaders, state-owned and hired, were hydraulically driven with in-cab adjustable controls with ground speed sensors. Material was applied to travel lanes at 300 pounds per lane mile. Reapplication was determined by pro-

Figure 1

THE COMMONWEALTH OF MASSACHUSETTS

INTER OFFICE CORRESPONDENCE DEPARTMENT OF PUBLIC WORKS

From: Maintenance Engineer

Attention of: Dep. Ch. Engr., Hwy. Maint. October 22, 1986

Subject: Low Salt Areas-
Low Volume State Highways

The following policy is recommended for the application of Sodium Chloride on low volume State Highways in the following areas:

All applications will consist of 1 part salt to 1 part sand and will be applied at the rate of 300 pounds per lane mile.

District 1		
Blanford	M Route (North Street)	1.5 miles
District 3		
Millbury, Sutton,	M Route	19 miles
Southboro-Westboro	Route 30	18 miles
Brimfield-Wales	Route 19	4 miles
District 5		
Salisbury	No. Beach Road	4.2 miles
District 6		
Mansfield	M Route (Central St.)	5 miles
Acushnet-Fairhaven	M Route (S. Main St.)	5.7 miles
Freetown, Berkley, Lakeville, Taunton	Old Rt. 140	24.3 miles
Canton, Westwood	M Route (Blue Hill Dr.)	3.9 miles

J.F. GALLAGHER, P.E.
MAINTENANCE ENGINEER

JFG/ab
cc: JFG,CJK,JG
jfg2/ad9

APPROVED - PUBLIC WORKS COMMISSION
OCT 29 1986

(ITEM NO.) n.1

Approved and tra... Robert H. J...
Chief Engi...

ject engineers. Plowing of treated snow began as snow exceeded two to three inches in depth. The quantity of material used was regulated by computer card monitoring.

Sodium chloride was delivered primarily by International Salt Company to test area maintenance depots at a cost of $28.33 per ton. Sand came from local vendors for $4.77 per ton.

The areas involved in this study were as follows:

District 1

Blandford

location: M. Route, North Street

length: 3 Lane miles

average road width: 22 feet

lanes: 2 travel lanes

ADT: 154 vehicles in 1974

tons per lane mile applied in test area: 5.76

tons per lane mile applied District wide: 8.86

percent difference: 33% reduction

Reports submitted by the test area foreman suggest that the test material applied in this area was entirely adequate in treating this road. However, this road is located in a heavy snow area and is open and exposed to prevailing northwest winds with accompanying extremes and cold temperatures. This resulted in a permanent pack being left on the test area surface for most of the winter. Storm temperatures ranged from 20 degrees to 32 degrees Fahrenheit. In most instances, pack persisted until temperatures advanced above freezing. Yet on occasion, this pack had to be treated with frequent "light" application of the test material during non-storm periods when adjacent sections were free of such pack. Therefore, the amount of sodium chloride applied overall came quite close to the amount applied to adjacent roadways. Although this roadway remained in poor condition for most of the winter, the test material was adequate to meet the needs of the public here. The traffic is so light during the winter that the continuous pack condition is not considered to

jeopardize public safety.

District 3

Sutton/Milbury

location: M. Route

length: 9.6 lane miles

average road width: 16 feet

lanes: 2 travel lanes

drainage: country drainage

ADT: 9,830 vehicles

Reports submitted by the area foremen indicate that the test material was not effective enough to provide a consistently safe travel surface to motorists during storm conditions where temperatures ranged between 22 and 28 degrees Fahrenheit. Under these circumstances the test material did not prevent packed snow on the road surfaces. Due to continuous complaints registered by local residents and by the Sutton Police Department, reapplication of the test material was continued.

The Material Control System was not able to generate figures for the quantity of sodium chloride which was applied to this area, because the District did not set up a special spreader route. However, the District was able to track material applications from December 29, 1986 through April 28, 1987. This data showed that a total of 14.34 tons of sodium chloride was applied to this test area, or 1.49 tons per lane mile that period. This information does not provide the Department with conclusive results as to the effectiveness of the test material or amount of reduction.

Southborough/Westborough

location: Route 30

length: 3.15 lane miles

average road width: 27 to 40 feet

lanes: 2 travel lanes

drainage: country drainage, some catch basins

ADT: 1,850 to 2,600 vehicles

tons per lane mile applied in test area: 3.15

tons per lane mile applied District wide: 20.71

percent difference: 85% reduction

Test section reports completed by the foremen stated that the test material proved generally ineffective in providing a safe travel surface during storm conditions. In eight of the nine storm reports submitted by the foreman, poor travel surfaces were recorded. Pack on road surfaces, slowed travel speeds, and skidding were all associated with the modified winter maintenance program in this location. Low storm temperatures, which ranged from 13 to 34 degrees Fahrenheit, contributed to these poor travel conditions. The Southborough Police Department on numerous occasions requested extra plowing and reapplication of test material. In only one instance where storm conditions existed did the test material perform in a suitable manner. Though the temperature was low, 27 degrees Fahrenheit, this one positive result may be attributed to a light snowfall.

Brimfield/Wales

location: Route 19

length: 17 lane miles

average road width: 25 feet

lanes: 2 travel lanes

drainage: country drainage

ADT: 200 vehicles

tons per lane mile applied in test area: 6.15

tons per lane mile applied District wide: 20.71

percent difference: 70% reduction

The test material is reported by the foremen to have performed favorably under most storm conditions. The information available concerning storm conditions in this test area is limited. However, favorable travel conditions were recorded during several of the storms in which temperatures ranged between 24 and 29 degrees Fahrenheit. In only one instance did a hard pack actually develop on the test surface. Unfortunately, it is impossible to determine the actual cause of this pack development, though it is most likely the result of a storm temperature of 26 degrees Faharenheit combined with freezing rain and snowfall.

District 5

Salisbury

location: North Beach Road

length: 8.4 lane miles

average road width: 26 feet

lanes: 2 travel lanes

drainage: catch basins

ADT: 3,455 vehicles

tons per lane mile applied in test area: 10.30

tons per lane mile applied District wide: 19.80

percent difference: 48% reduction

The foremen's reports for Salisbury were generally negative concerning the effectiveness of the test material. It performed satisfactorily at temperatures above 32 degrees Fahrenheit. During storm conditions in which temperatures were 16 degrees to 32 degrees Fahrenheit, pack and pack with a slushy cover developed and persisted. Traffic conditions during such periods were unfavorable.

District 6

Mansfield

location: Central Street M Route

length: 7.3 lane miles

average road width: 40 feet

lanes: 2 travel, 2 breakdown

drainage: catch basins

ADT: Not available

tons per lane mile applied in test area: 61.42

tons per lane mile applied District wide: 26.16

The foreman's reports for the Mansfield test provides limited information regarding the effectiveness of the test material as a deicing agent. The report was clearly unfavorable. Pack and slushy pack developed and persisted on test surfaces during all storm periods recorded. However, the reports and the Data Control Sheets for this test area are inconsistent. It can only be said that the results for Mansfield are inconclusive.

Acushnet/Fairhaven

location: South Main Street on M. Route

length: 16 lane miles

average road width: 33 feet

lanes: 2 travel lanes

drainage: catch basins and country drainage

ADT: 6,610 vehicles

tons per lane mile applied in test area: 6.67

tons per lane mile applied District wide: 26.16

percent difference: 74% reduction

Reports submitted by the test area foreman state that the test material applied to the roadways during numerous storm periods was not adequate to provide a safe travel surface to the public. Pack and slippery road conditions developed in the majority of storm periods. Storm conditions with temperatures 32 Degrees Fahrenheit and below often resulted in an unsafe travel surface. The District increased the number of reapplications and the rate of plowing. As temperatures rose above 32 degrees Fahrenheit the test material became more effective.

Freetown/Berkley/Lakeville/Taunton

location: old Route 140

length: 24 lane miles

average road width: 31 feet

lanes: 2 travel lanes

drainage: 15% catch basins, 85% runoff and leaching basins

ADT: 10,316 to 16,808 vehicles

tons per lane mile applied in test area: 22.03

tons per lane mile applied District wide: 26.16

percent difference: 16% reduction

The test area reports from the foreman monitoring the project indicate that the test material was ineffective in clearing road surfaces. When temperatures ranged from 13 to 35 degrees Fahrenheit, pack and slippery travel surfaces were reported to have occurred frequently. Continued reapplication of the test material and plowing were conducted in an attempt to clear the travel surface. There were no reports which indicated that the test material had functioned adequately as a deicing agent.

Canton/Westwood

location: Blue Hill Drive on the M Route

length: 3.5 lane miles

average road width: 30 feet

lanes: 2 travel lanes

drainage: catch basins and country drainage

ADT: not available

tons per lane mile applied in test area: 20.29

tons per lane mile applied District wide: 26.16

percent difference: 22% reduction

The reports submitted by the Canton and Westwood foreman provided very little information regarding the effectiveness of the test material. The material appeared to have performed similarly to the other test areas on low volume secondary roadways. It was more effective during storm periods with temperatures in excess of 30 degrees Fahrenheit. During storm periods in which temperatures remained below 30 degrees Fahrenheit, the test material's performance was inconsistent, allowing snow pack and unsafe travel surfaces to develop.

Summary of Results in Reduced Salt Application on Low Volume Secondary Roadways: In summary, the results and recommendations for the salt reduction studies on low volume, secondary roadways closely resemble those in the concluding statements of the salt reduction report on roadways in the vicinity of municipal water supplies. The Districts which participated in this study complied with the program outlined by the Department to the best of their abilities. However, confusion did exist as to the actual implementation of this program. Despite problems which arose in the operational procedures, the project was able to produce valuable information regarding the practical effectiveness of this material on low volume roads.

It is recommended that the Highway Maintenance Division review each of the test sites for inclusion in the 1987-1988 program. It is important to evaluate each to determine whether the conditions make it a viable low salt area. This would include consideration of the spreader route, the traffic, the lay-out of the roadway (curves or hills in a shaded location), and general safety considerations. Because these experiments are not tied to drinking water supplies, maintaining the safety and service to the public is of primary importance. A low salt area requires a higher concentration of personnel and capital resources. Therefore, the Department should eliminate any of these

experimental areas, in which there is doubt about the ability of the district to commit the resource to maintain the service or in which there are conditions that make the location not appropriate for low salt application.

VI. Calcium Magnesium Acetate

Recognizing the environmental uncertainties of continued salt application to Massachusetts roadways, for a number of years the Department of Public Works has sought alternative deicing methods. Although experiments have been done with new pavement materials and with installation of heating elements in the pavement, no alternative deicing material was available until calcium magnesium acetate (CMA) was introducted several years ago.

The Department has had an interest in testing the effectiveness of CMA. However, the critical question to be answered before it could be considered for general use was how it might affect the environment. To date, there are no definitive studies on CMA's movement in groundwater, its effect on soil or water chemistry in the environment, or the effect of releasing any impurities in the material during the manufacturing process.

The Department was reassured on this account by DEQE's position. In a letter in June, 1986, DEQE Commissioner S. Russell Sylva requested the Department to investigate and test the effectiveness of CMA. There were additional assurances from DEQE engineers during interagency meetings that CMA poses no harmful environmental effects to groundwater or soils. Relying on these assurances and the limited test results available, the Department made the decision to field test CMA. However, believing it to be imprudent to expose any drinking water supply to the still uncertain effects of a new deicing material applied at perhaps twice the rate of salt, the Department chose a test location isolated from public or private water supplies.

The Department began a literature search of other state highway agencies which had tried calcium magnesium acetate and of the federal government to determine the suitability of this material as a deicing agent. Information was received from the Federal Government Office of Research and Development and the states of Iowa, Maine, Michigan, Minnesota, Washington, and Wisconsin. Test data varied regarding the actual usage of CMA. Field testing had been performed on the early form of CMA. It was initially manufactured in a flake form. The newer version, called isodimensional, is in pellet form. The Department decided to experiment with the newer isodimensional form, which was sup-

posed to have deicing capabilities similar to sodium chloride.

The research on field testing isodimensional CMA indicated that one and one half to two times the amount of CMA would be required to achieve the same result as the currently-used deep-mined rock salt. The engineers expected that it would be necessary to apply CMA at a rate of 600 lbs per lane mile. The Department used this information as a quantity guide in ordering material for this experiment.

The Department then began to examine areas most appropriate to determine the handling characteristics of this material. The areas submitted by DEQE around municipal water supplies were reviewed. However, it was decided that the environmental factors, plus traffic volume and vehicular speeds in these areas, made it impractical to use this new material near any of them.

The decision was made in late August 1986 to incorporate the use of CMA into the winter program of the Department for 1986-1987. The area chosen was a two-lane state highway under the jurisdiction of the Department's District 6 in the town of Somerset, Route 138. The test area runs from Route 6 near the estuary of the Taunton River northwesterly 4.783 linear miles (12.609 lane miles) ending at the Somerset-Dighton Town Line. This roadway had a fairly wide variation of climatic influence, ranging from a warmer, moist effect at its southern end to a cold, and dry extreme in its northern section. The wearing surface is comprised of "Type-I" bituminous concrete with a closed catch basin system and some country drainage in the northern section. Vehicular speed limits on this roadway average 30 miles per hour with an ADT of 16,600. The traffic pattern is predominately urban in nature with many cross streets and several signal regulated intersections. The roadway is fairly level with grades ranging from 0.4% up to 3.28%.

A control roadway was chosen for comparison purposes. This was Route 103 running through the town of Somerset and Swansea. The control area begins at the intersection of Route 6 in Somerset, which is at the terminus of the test section, and runs to the Rhode Island Line in Swansea, a total distance of 4.9 linear miles (14.3 lane miles). The control roadway has characteristics similar to the test area, but runs in a more east to west direction.

The CMA material specification was put together using the Federal Specification as a guideline for 300 tons of this material. The specification was submitted to the State Purchasing Agent on August 14, 1986, and the bid was opened by that office on September 19. Three bids were receive to supply the

material: $1200.00 per ton, furnished by Verdugt B.V., Tiel, Netherlands; $826.52 per ton, furnished by Gancy Chemical Corp., Syracuse, N.Y., and $556.00 per ton, furnished by Chevron Chemical Co., Fort Madison, Iowa. The Department, by a vote of the Board of Commissioners on September 24, 1986, approved the low bid of Chevron Chemical Co. and the Purchasing Agent's Division subsequently formalized a contract with them on October 30, 1986, at a total cost to the Department of $166,800.00. The cost of sodium chloride delivered to the area for the season was $24.36 per ton. Therefore, CMA was almost 23 times more expensive than salt.

. An effort has been underway since November, 1986, to develop a process for manufacturing CMA at a lower cost. Dynatech Corporation of Cambridge, Massachusetts, began a project to reduce the cost of extracting the raw materials (calcium and magnesium, found naturally in dolomitic limestone, and acetic acid, found in fruits and plants). The objective is to create a single reactor biological process, which will reduce costs of production. The Department of Public Works contributed to the Dynatech project, which is primarily funded by the New York State Energy and Development Authority. The project was an important factor in the Department's decision to test CMA, because it would not be feasible to consider it as an alternative to salt or Pre-Mix at the presently prevailing prices.

Delivery of the CMA began on November 11, 1986, arriving from Chevon's Fort Madison, Iowa plant. Originally scheduled to be shipped by rail, the manufacturer found it less expensive to deliver by covered trailer truck. The material was hauled directly from the plant to the Department's Maintenance Depot in Swansea at the junction of Routes 195 and 118. CMA was delivered in 25-ton lots. The material was off-loaded directly into one of the Department's standard enclosed pole barn type storage buildings with outside dimensions of 40 feet by 80 feet and a 16 foot square doorway. The trailer truck backed directly into the building and deposited the material via an undercarriage conveyor system. This part of the operation was very dusty, and personnel were removed from the general area until the off-loading was completed and the dust settled. The material was then stacked by a Department front end loader. The dust raised by the front end loader was not excessive in the stacking part of the operation. This process was repeated until delivery was completed on November 24, 1986.

The Department utilized a 1980 International dump truck throughout the winter for the application of the material in the test area. This vehicle was equipped with a six cubic yard hydraulically driven Torwell spreading unit with a Dickey-John

synchrometer unit that allowed consistent material output with changing vehicle speeds. The spreading unit was manually calibrated with the CMA to produce an application rate of 300 lbs. per lane mile of roadway, the same as the Department's standard application rate for sodium chloride that was applied to Route 103. The spreading unit was enclosed by a canvas tarpaulin after loading to prevent possible caking of the CMA if exposed to moisture. The width of spread was set for twelve feet.

The first storm period that required the use of CMA on Route 138 occurred on December 9, 1986. Material was loaded into the spreader by a front end loader which produced a noticable cloud of dust. The storm lasted for approximately two hours, and one application was made on the entire test area approximately one half hour after the storm began. Snowfall was light and reports indicate that the CMA began to melt the precipitant in about seven to ten minutes. Sodium chloride applied to Route 103, the control section, began melting almost immediately producing a brine in about five minutes. The test roadway went to bare and wet in about one half hour with temperatures ranging from 28 to 32 degrees Fahrenheit. The personnel were pleased with the way the material worked.

The next storm occurred on December 11 and 12, 1986, and was a more severe storm. Again temperatures hovered around 32 degrees Fahrenheit with a maximum rate of snowfall of one inch per hour, a total accumulation of four inches of snow fell over a ten hour period. CMA was applied about one half hour after the storm began, and again it started to work within ten minutes of application. The exceptions to this were bridge decks where it appears the material required about one half hour to produce some melting.

Observations by the engineer and foreman on the project indicate that the CMA worked well, keeping the snow in a mealy or slushy condition with no apparent bonding to the roadway surface. It does not melt snow in the same manner as sodium chloride, which produces a running brine, but rather CMA burrows through the snow down to the pavement. As a result plows were called in to slush off the pavement earlier in the storm than in the control section. Normal plowing in the control area began as accumulations approached three inches. However, it was determined for the CMA section that, for the rate the material was being applied, plowing should commence when accumulation approached two inches.

Mechanical problems forced the use of a substitute spreader which was not calibrated to apply the CMA. The application rate of this vehicle had to be adjusted down to accommodate the

free flowing CMA as spreading runs were made, until the original vehicle was back in service prior to the end of the first storm. This resulted in an average application rate for the storm period of 400 lbs. per lane mile rather than the prescribed rate of 300.

The snow and ice engineers had expected the spherical CMA to bounce excessively when it was applied, but they found that this was not the case as long as precipitant was visible on the roadway surface. No special directive was given to the operator of the spreader traversing the test area section to limit his speed, to assure that the CMA would be applied at speeds similar to the sodium chloride in the control area. The CMA tended to cake on the spinner of the spreader. However, it was easily knocked loose by the operator after each run. At the conclusion of the second storm the District personnel were satisfied that the CMA worked as well as sodium chloride.

The next several storms had temperature ranges in the 28 to 38 degrees Fahrenheit range and the material behaved essentially as it had in the previous storms. Summary reports are included following this page for all storms indicating comparative figures.

The true test of this material would be its effectiveness in temperatures below the 28 degree Fahrenheit range. All available documentation indicated that the material becomes less effective when that occurs. A minor storm, accumulation of precipitation of ¼ inch, and temperatures in the range of 16 to 20 degrees Fahrenheit, occurred on January 4 and 5, 1987. Only one application of CMA was made, and melting ensued in about fifteen minutes. It produced a wet pavement in about one half hour.

On January 26, 1987, the District experienced the coldest storm of the winter, a northeast storm that eventually deposited 10 inches of snow in the test area. Temperatures ranged from 23 degrees Fahrenheit at the beginning of the storm at 3:00 a.m. to a low of 9 degrees fifteen hours later when the storm abated. The initial application of the CMA took approximately ten to fifteen minutes to begin melting, but as the temperature dropped, reports indicated that the CMA took about one half hour to forty minutes longer to perform. Application frequency was doubled from an average of every two hours to every hour. As the storm progressed, snow fall intensified to 1½ inches per hour and temperatures dropped to 20 degrees Fahrenheit. The CMA application that followed was placed at 475 lbs. per lane mile due to storm intensity. The temperature continued falling and another application was made at 300 lbs. per lane mile. Five hours into the storm the CMA appeared not to be working from an observers view as no apparent melting occurred, and a double

Route 138, Somerset

SUMMARY REPORT

DATES	12/9/86	12/11-12/86	12/30/86	1/2/87	1/4-5/87	1/10/87
STORM DATA						
Snow fall, inches	½	4	4½	4	½	Trace
Rate, in/hr.	¼	1	½	½	1/8	-
Duration, Hrs.	2	10	16	14	5	4
Temperature	28-32	32	30-35	30-34	16-20	3
Wind, mph	12	10	10-15	12-30	15-20	12-13
LOAD						
Lbs. CMA	3,000	15,000	24,000	18,000	4,000	200
SPREAD DATA						
Rate of spread, lbs./LM	300*	400**	300*	300*	300	300
Applications	1	4	8	6	1	Spot Application
Time between applications (hrs.)	0	2	1½	2	-	-
Time Snow began	2:00 a.m.	3:30 p.m.	2:00 p.m.	10:30 a.m.	11:30 p.m.	7:30 a.m.
Time Spreading began	3:30 a.m.	4:45 p.m.	4:00 p.m.	5:15 p.m.	12:30 a.m.	7:30 a.m.

*The material spreader was manually calibrated with C.M.A. correctly. The lane miles were not physically measured until 1/3/87 and were found to be 12.609 rather than the 10.0 assumed, after which the loading was adjusted to accomodate the change.

**Mechanical breakdown forced the use of a substitute spreader not calibrated for C.M.A.

CONTROL AREA - ROUTE 103

Sodium Chloride Applied (lbs.)	6,000	16,000	60,000	30,000	None Applied	None Applied

Route 138, Somerset

SUMMARY REPORT

DATES	1/18-19/87	1/19/87	1/19-20/87	1/22-23/87	1/23/87	1/26/87
STORM DATA						
Snow fall, inches	1½	1½	4½	6	¼	10
Rate, in/hr.	¼	0.2	½	1½	1/8	1½
Duration, Hrs.	4	7½	14	12	6	15
Temperature	30	30	23-28	30-38	20-26	16-20
Wind, mph	10	10	10-15	20	15	15-20
LOAD						
Lbs. CMA	8,000	8,000	36,000	22,000	8,000	46,000
SPREAD DATA						
Rate of spread, lbs./LM	300	300	300	300**	300	300
Applications	2	1	9	5	2	10
Time between applications (hrs.)	2	-	2	2	2	2
Time Snow began	11:30 a.m.	3:00 a.m.	12 Noon	1:00 p.m.	6:00 p.m.	3:00 a.m.
Time Spreading began	12:30 a.m.	3:30 a.m.	1:00 p.m.	2:00 p.m.	7:00 p.m.	4:00 a.m.

*One Application Applied at 475 lbs./lane mile due to breakdown of plow, to hold roadway until equipment was back in service.

**One Application made at 635 lbs. per lane mile and two applications made at 475 lbs. per lane mile due to temperature. One Application at the culmination of the storm made at 160 lbs. per lane mile.

CONTROL AREA - ROUTE 103

Sodium Chloride Applied (lbs.)	7,000	None Applied	60,000	33,000	10,000	51,000

Route 138, Somerset

SUMMARY REPORT

DATES	1/30-31/87	2/4/87	2/6/87	2/7/87	2/9/87	2/23/87
STORM DATA						
Snow fall, inches	3½	1	Trace Accum. (icey)	Trace (icey)	7	2
Rate, in/hr.	1	.67			1	½
Duration, Hrs.	6	1½			16	7
Temperature	30-35	31	32	29	13-20	31-33
Wind, mph	10-15	10-15	0-12	0-12	20-50	NE
LOAD						
Lbs. CMA	22,000	4,000	4,000	2,000	56,000	8,000
SPREAD DATA						
Rate of spread, lbs./LM	350*	300	300	Spot Application	350**	300
Applications	5	1	1		13	2
Time between applications (hrs.)	1	-	-	-	1½	3
Time Snow began	6:00 p.m.	10:30 p.m.	10:00 p.m.	10:00 p.m.	10:00 a.m.	6:00 a.m.
Time Spreading began	7:00 p.m.	11:20 p.m.	11:00 p.m.	11:00 p.m.	11:00 a.m.	8:30 a.m.

*One Application applied heavily at 375 lbs. per lane mile due to storm intensity.

**Four Applications placed at 375 lbs. per lane mile due to temperature, three applications at the storms and made at 160 lbs. per lane mile at storms culmination.

CONTROL AREA - ROUTE 103

Sodium Chloride Applied (lbs.)	30,000	5,000	3,000	2,000	69,000	8,000

SUMMARY REPORT

DATES	3/2-3/87
STORM DATA	
Snow fall, inches	1/8
Rate, in/hr.	-
Duration, Hrs.	18
Temperature	30-36
Wind, mph	10
LOAD	
Lbs. CMA	4,000
SPREAD DATA	
Rate of spread, lbs./LM	300
Applications	1
Time between applications (hrs.)	-
Time Snow began	10:00 a.m. (Mon.)
Time Spreading began	4:00 a.m. (Tues.)

CONTROL AREA - ROUTE 103

Sodium Chloride Applied (lbs.)	10,000

application was applied. However, packed snow on the highway did not develop and the precipitant remained plowable. At 5:00 p.m. temperatures were down to 9 degrees Fahrenheit and an application was made again at 475 lbs per lane mile. The final application was at 8:30 p.m. at 300 lbs. per lane mile. This cleared the road to bare and wet. In comparison with the control area for this storm, the foreman reported that additional applications of the CMA were required to bring the pavement to a bare, wet condition once precipitation stopped. Also noted was the fact that as vehicular traffic increased the CMA appeared to work faster than when traffic was lighter.

Another storm with low temperatures in the 13 to 36 degrees Fahrenheit range occurred on February 9, 1987. Over a sixteen hour period this storm deposited seven inches of snow. This storm began at 8:30 p.m. as rain with temperatures at 36 degrees Fahrenheit. The temperature steadily dropped as the storm progressed, and by 12:30 a.m. the temperature had dropped to 18 degrees Fahrenheit. Nine applications of CMA were made. The engineer reports that CMA was still working, but very slowly, due to the limited amount of traffic. The rate of application was stepped up to 475 lbs. per lane mile, a judgement made in the field to accommodate the low temperatures and lack of reaction. Four applications were made in this manner. It appears that in order for the material to work to its maximum potential at these temperatures CMA must be assisted by the friction caused by vehicle tires on the roadway. By 2:30 a.m., temperatures had dropped to a low of 15 degrees and without traffic, the CMA did not appear to be working. Since there was no traffic, applications were suspended until the morning commute at 6:30 a.m., when one more application was made. In the control section where straight salt was applied, the salt was working slowly, but noticeably better than CMA, during the same low traffic time period. Twenty minutes after the application, with the temperature at 15 degrees and some light traffic, the snow on the pavement showed signs of melting. Again no packed snow developed throughout the storm and the pavement went to bare and wet by 10:30 a.m., the same time as the control section.

During the winter, three instances occurred which occasioned the use of sodium chloride in the test area and the experiment was temporarily suspended.

1. On January 23, 1987, a light snow was falling. CMA was spread on the roadway. The snow continued and a second application was in progress. A one mile section of the southbound roadway did not receive the second application, because the CMA spreader had expended all its material. There was a freeze over that section. There

were a few minor skidding accidents and complaints from the local police. Vehicular traffic was detoured. In order to alleviate the condition, the first available spreader, which was loaded with sodium chloride, was immediately dispatched to the scene.

2. On the evening of February 10, 1987, an ice condition developed on Route 138, and within the test area spot sanding was required, but as explained above, CMA is not adaptable to this type of operation. Sodium chloride was used on a limited basis.

3. On March 2, 1987, a light snow was followed by intermittent snow flurries which were forecast to continue throughout the night. In this situation, in order to make the road safe without constant attention, a light dusting of chemical is required. As explained above, CMA is not adaptable to this type of operation, and therefore, sodium chloride was used on the test section and throughout the remainder of the roadways in the repair section.

Accident data for the Route 138 test area indicates an increase in the storm related accidents from zero during the period October 1985 through May 1986, to seven for the same period 1986 to 1987. Two of these accidents occurred in December, 1986 and five in January of 1987. Reports received from the Somerset Police Department show that four of the five reported accidents in January occurred during the January 23 mishap described above. This indicates that accidents increased from zero to three over the course of the 1986-1987 winter.

The Department attempted to purchase weather analysis equipment to compare ambient temperature readings with readings from a probe installed in the pavement. This was delayed due to fiscal budgetary constraints and was finally delivered in the spring of 1987. It was the intent to utilize this apparatus to better correlate weather data with the reaction of CMA applied to the pavement. It will be installed in the area where CMA testing is continued next season.

The CMA material appeared to work quite well at all times when temperatures were around 20 degrees Farenheit and higher. The CMA required more lead time for application than sodium chloride, because CMA has a slower rate of reaction on highways and, more importantly, on bridge decks, where it took up to one half hour to begin to melt precipitant. This slow reaction meant that personnel had to be called in earlier (at the first signs of

precipitation) and initial applications of CMA had to be made more quickly than sodium chloride. The material, which was isodimensional in configuration, was difficult to apply when there was little or no precipitation or ice on the roadway, because it bounces on a dry pavement. In instances such as these, sand must be used to control the CMA material when applied and to counteract the activity of vehicles that tend to sweep material off to the sides. Also, the CMA was manufactured with a gradation the same as sodium chloride, and it appeared that the larger dimension material was not dissolving completely before being plowed off the roadway. At temperatures of 20 degrees Fahrenheit and below, it appeared that the rate of application had to be increased as well as the frequency of application. Noted in conjunction with this was the fact that at these temperatures, the material required the action of vehicular traffic to begin working. Otherwise, it tended to lie on the surface of the precipitant. In larger traffic volumes at cold temperatures, CMA consistently worked better than in periods of low traffic volume. Overall, for the type of roadway in this experiment, CMA was comparable to sodium chloride in effectiveness. However, to use this material on a high speed - high volume roadway without further testing is not recommended.

VII. Verglimit; Plus Ride

The Department has also experimented with innovative methods of reducing the amount of applied deicing materials by using new pavement technology. The two types of pavements studied were "Verglimit" and "Plus Ride". The Verglimit pavement consists of encapsulated calcium chloride and Linseed oil mixed and placed in the top wearing course of Bituminous concrete pavement. When traffic wears the pavement surface, it exposes a Verglimit grain and, due to its deliquescence, forms a calcium chloride brine on the roadway when activated by precipitation. "Plus Ride" is a flexible rubber-asphalt pavement which consists of ground rubber placed in the top wearing course of the pavement. The pavement, with the action of traffic on it, flexes and breaks the bond between the pavement and the precipitant.

The Verglimit has been applied to three areas across the State: Littleton, Route 2 (1.0 linear mile placed in 1981); Goshen Village area, Route 9 (2 linear miles placed in 1985); and Easton, Route 123 (1.0 linear mile west to the junction with Route 24 including the southerly on and off ramps, placed in 1986). The Plus Ride pavement, placed in 1986 in Easton, also ran from the junction with Route 24 east for 1.0 linear mile and included the northerly on and off ramps. The Verglimit adds

$75.50 to the in place cost of the Bituminous concrete and the Plus Ride cost is $44.50 additional per ton.

Observations on both pavement types during the course of the winter, indicated that traffic was a necessary addition during storm conditions to allow both materials to work to their optimum. It appeared that the more traffic traversing these experimental pavements, the better both pavements worked. However, when traffic volume and temperatures decreased, the Verglimit worked more slowly and the Plus Ride seemed not to work at all. Applications of sodium chloride were made in most instances to both types of pavements. During the initial phases of a storm, both types of pavements prevented bonding by the precipitant providing longer lead time before requiring applications of deicers. The short stretches of placement of these pavements allowed the carry over of sodium chloride by the traffic from the adjacent sections of roadways which were deiced. Therefore, there has not been a conclusive analysis of the effectiveness of the pavements alone. Also, it appears that the Districts treated these pavements with applications of deicing materials similar to materials used on adjacent sections. At the termination of storms, the experimental pavements cleared faster and there were fewer instances of call backs to treat icing conditions in these areas.

Verglimit and Plus Ride are not total replacements for deicing materials used in the Department's winter maintenance program. They are, however, a useful tool in certain locations when used in conjuntion with the Department's program already in place.

VIII. Recommendations

In conclusion, it is recommended that the Pre-Mix program on Route 128 be continued next season and that plans be put into effect to expand it to another area in District 4. The area recommended by the District is in the vicinity of the North and East Chelmsford Water District Municipal Water Supply. The roadways affecting these supplies include a section of Route 3 in the vicinity of Route 495, the Lowell Connector and the ramps and interchanges between Route 3 & Route 495. It is optimistically felt that this area could be treated similarly to Route 128 with minimal impact on the motoring public. To carry this program forth to other municipal water supply areas on high speed - high volume roadways submitted by DEQE is not recommended at this time.

The results of the Cape Cod experiment were generally favorable with the exception of the February 9 storm. This

program should be continued. However, it is not advisable to use sand/salt or sand/Pre-Mix mixtures throughout the Commonwealth in non-salt sensitive areas. It is not appropriate in most cases for high speed/high volume highways, because it is critical to keep traffic flowing smoothly on these roadways. The feasibility of relying on these mixes depends on weather conditions, which vary dramatically across the state. Furthermore, lack of equipment, facilities, and personnel specially trained in low salt deicing techniques are important considerations. The loss of service of the roadways would be unacceptable if these procedures were implemented on a broader scale.

Upon reviewing the test results for municipal water supplies and secondary roadways, the data suggests that the mixes utilized this past season (one part sand to one part salt) were inadequate as temperatures dropped below 28 degrees Fahrenheit. In order to combat that problem it is recommended that Pre-Mix be used in place of sodium chloride in the ratios already discussed. Also, the limits on the areas involved in the municipal water supplies and secondary roadway experiments should be extended to allow better control of spreading, as well as better record keeping. Again, the secondary roadway test area should be reviewed for feasibility. Highway safety and service to the public should be the primary goal where no public water supply is affected.

The CMA experiment appeared successful from an operational standpoint last season. Since the area setup on Route 138 was intended to test the handling aspect of the material, rather than to alleviate the impact on specific water supplies, it is recommended that the area of this experiment be changed. Since the Department still has some of last winter's shipment of CMA in stock, the area chosen should not be too distant from the 1986-1987 test area. The location recommended is Route 140, Old County Road, in Freetown. The Department has received between 70 and 100 complaints from abutters whose wells contain high sodium levels. The District has been collecting well water samples from these residents, sending them to the Department's Research and Materials Laboratory to be analyzed. It is felt that this data base will greatly enhance further research on CMA migration and its effects on groundwater. It is also recommended that DEQE participate with the Department in the analysis and evaluation of the environmental effects of CMA in this location.

Another recommended CMA experimental location is a portion of Route 25 between Wareham and Bourne. This is a new roadway, for which the Department was issued an Order of Conditions by DEQE in October 1986. This recommendation is based on the success of the Route 138 experiment. It forms a basis for going forward with CMA testing on a high volume, high speed roadway. This order

states that no chlorides are to be applied on a one-mile stretch through the Mann Bog area in Wareham. DEQE has specifically requested the Department to test CMA at this location in a letter from Commissioner Sylva dated July 6, 1987. It is recommended, with the assurance of DEQE that CMA will not adversely affect the water supply or the agricultural activity there, that CMA be used to deice this section of Route 25 next winter.

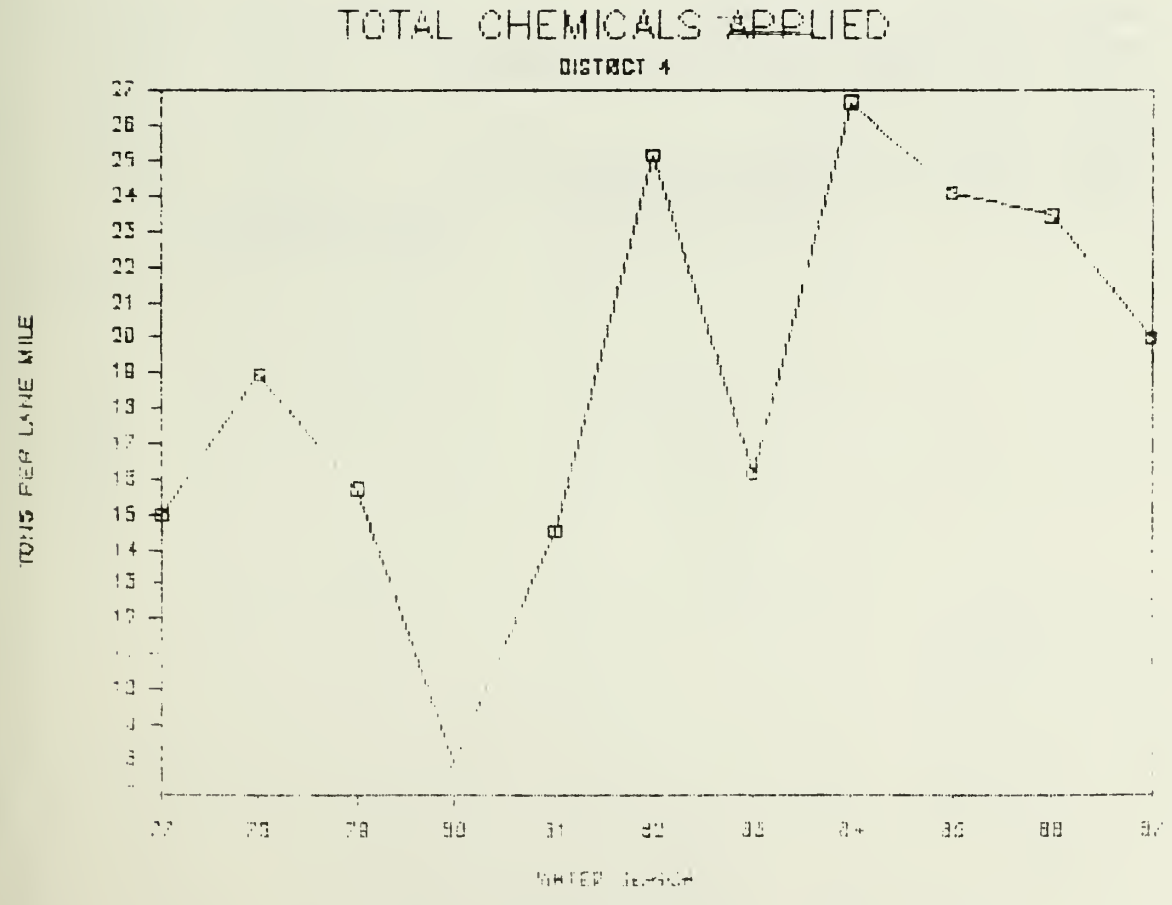
Appendix A
Route 128 Data

CHEMICALS APPLIED

EARLY TOTALS-DISTRICT 4

SEP	LANE MILES	TONS USED	IN. SNOW	TONS/LANE MILE
1977	1,793.24	25,919.00	78.30	14.45
1978	1,793.24	34,047.00	97.60	18.98
1979	1,798.24	29,255.00	40.50	16.27
1980	1,793.24	14,175.00	18.10	7.90
1981	1,793.24	26,111.00	78.50	14.56
1982	1,796.24	45,241.00	78.60	25.18
1983	1,796.24	26,985.00	54.40	15.02
1984	1,790.24	47,959.00	86.10	26.79
1985	1,799.24	43,018.00	77.50	23.91
1986	1,799.24	42,128.00	77.10	23.42
1987	2,033.66	40,608.40	77.50	19.97

** NOTE: WINTER SEASON 1976/77
DENOTED BY 1977, etc.



[1] estimated before final figures were available.

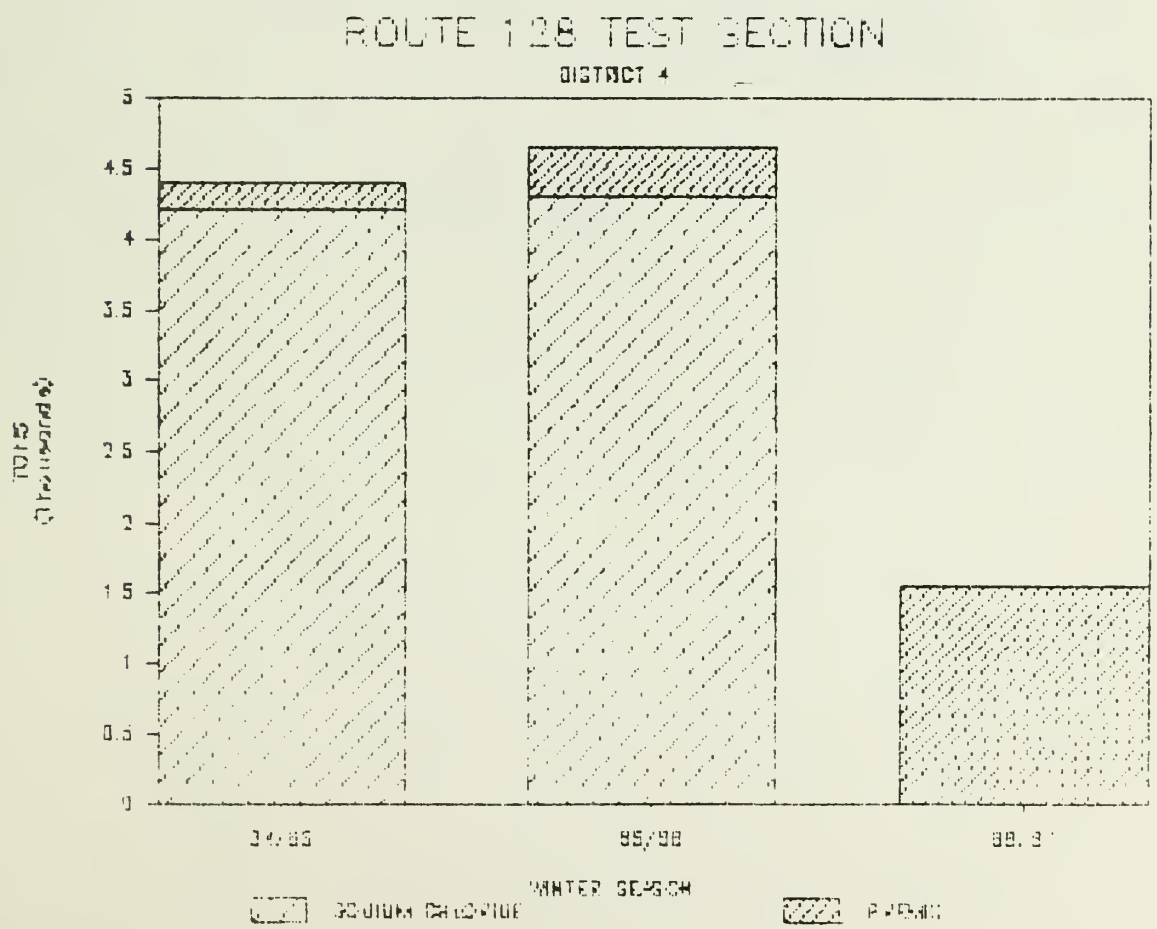
GANG #	TONS DELIVERED	TONS APPLIED TEST SECTION
4-6	532.27	418.67
4-7	193.83	91.92
4-7A	181.74	90.87
4-6B	1412.32	900.15
4-10	293.13	50.00
	2629.25 TONS	1551.61 TONS

DESCRIPTION OF TEST SECTION	LANE MILES	GANG
ROUTE 128, FROM ROUTE 30 TO ROUTE 2A	69.60	4-6B
ROUTE 2!	6.00	4-10
ROUTE 2 AND ROUTE 2A	13.51	4-7/7A
RAMPS, FROM ROUTE 30 TO TRAFELO ROAD	15.75	4-6B
RAMPS, ROUTE 2 AND ROUTE 2A	6.60	4-6
	110.56 LANE MILE	

ROUTE 128 TEST SECTION

YEAR	SAND	%	TEST	SALT	BRINE	NaCl	NaCl
84/85	4+4 CY	[illegible]	[illegible]	1211.00	200.00	4574.00	26.12
85/86	4+4.33 CY	[illegible]	[illegible]	1704.00	150.00	4584.00	29.47
86/87	TEST	[illegible]	[illegible]	0.00	1291.11	1241.29	11.47

NOTE: QUANTITIES FOR WINTER SEASONS 84/85, AND 85/86 ARE ESTIMATED.
QUANTITIES FOR WINTER SEASON 86/87 ARE ACTUAL.



[illegible] TONNAGE FOREMAN SECTION

EXCLUDED TEST SECTION

[illegible]	[illegible]	SALT	REMI[illegible]	TOTAL [illegible]
1-[illegible]	LEXINGTON	3844.00	139.56	3975.56
1-5A	ASHLAND	2275.11	1.00	2276.30
1-5B	WESTON	0.00	312.17	249.74
1-[illegible]	CONCORD	1229.11	21.72	1301.34
1-[illegible]	LEXINGTON	2604.50	90.87	2679.30
				==========
				11486.33 TONS

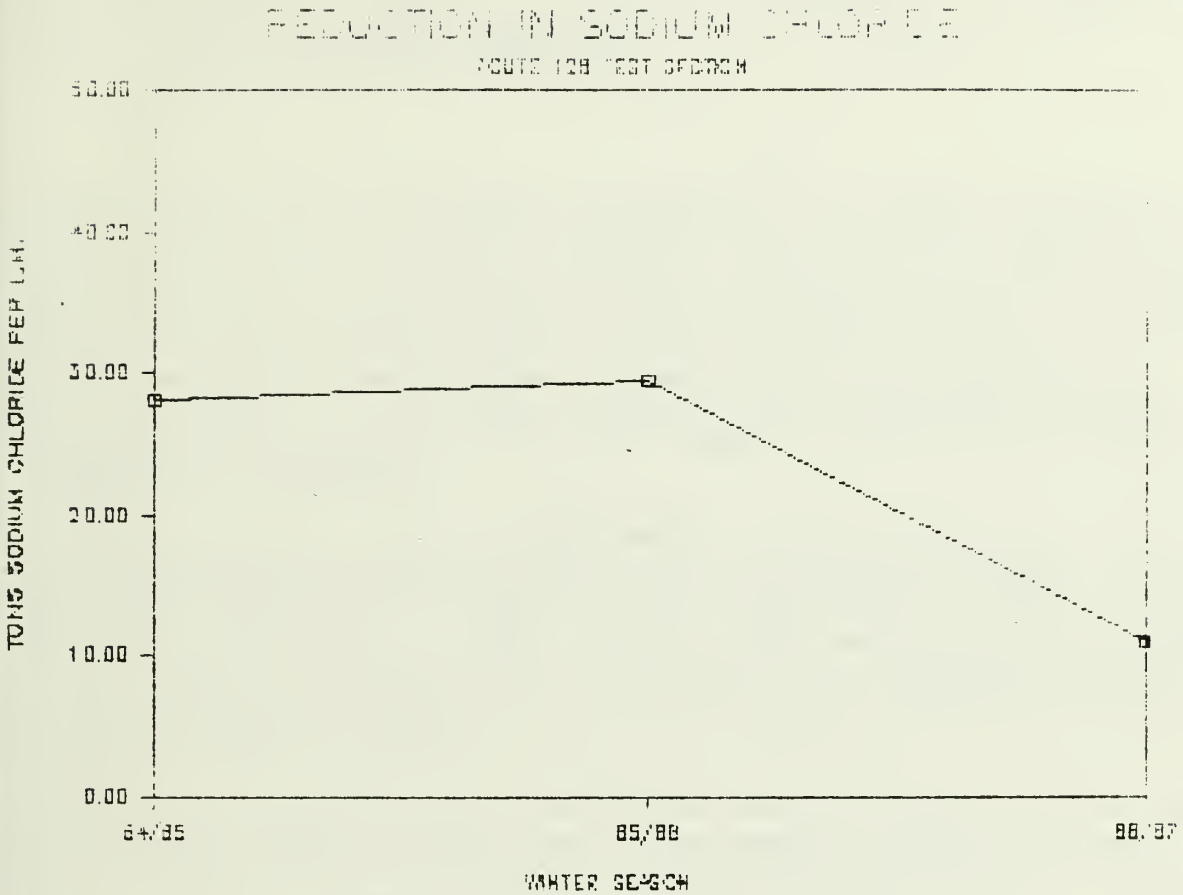
TOTAL LANE MILES IN HMF SECTION: 514.94 L.M.
TOTAL LANE MILES IN TEST SECTION: 112.56 L.M.
==========

REMAINDER OF HMF SECTION: 402.38 L.M.

TOTAL TONS/L.M. SODIUM CHLORIDE = 28.55 TONS/L.M

PERCENT REDUCTION IN SODIUM CHLORIDE
COMPARED TO THE REMAINDER OF THE
HMF SECTION IS:
11.03/28.55 = 0.39

61% REDUCTION
==========


REDUCTION IN SODIUM CHLORIDE
ROUTE 128 WEST BEDROOM
50.00
40.00
30.00
20.00
10.00
0.00
TONS SODIUM CHLORIDE PER LAN.
84/85
85/86
86/87
WATER SEASON

Appendix B
Accident Rates

Appendix B

THE COMMONWEALTH OF MASSACHUSETTS

INTEROFFICE CORRESPONDENCE — DEPARTMENT OF PUBLIC WORKS

FROM: Robert L. Shea, Traffic Engineer

ATTENTION OF: Frank A. Bracaglia, Environmental Engineer — June 30, 1987

SUBJECT: SALT MONITORING WORK PLAN

Reference is made to your interoffice memorandum dated 12/22/86 stating that the Chief Engineer directed the Bureau of Transportation, Planning and Development (BTP&D) to gather accident statistics showing a comparison to accidents before and after the reduced salt application rates on certain sections of the State Highway in the winter (October - May) of 86/87. Specific locations are 1. Hobbs Brook and Stony Brook adjacent to Route 128 in Lexington/Waltham, and 2. Somerset - Route 138. It was further requested that BTP&D gather the before and after accident data in all the reduced salt application areas to the extent that the information is available.

To accomplish this task a copy of item #35 (pg. 17) from the minutes of the Board of Commissioners meeting of 11/5/86 was acquired (see attached). Five locations were selected for additional review. They are: 1. Auburn - Route 12 2. N. Reading - Route 28 3. Avon - Harrison Blvd. between Route 24 and Route 28 and Route 28 from Randolph Town line to Route 37 4. Abington/Rockland from Route 123 to Route 18. A total of seven locations were selected for before and after accident data collection.

The accident data was collected at each of the seven City/Towns police station and every accident report which occured in the specified time period was xeroxed. Somerset did not allow xeroxing of the accident reports. Data was transposed from the accident reports to a tally sheet (see attached). Data was then placed on a microcomputer. One comparison was a graph of the 85-86 accident data compared to the 86-87 accident data. The other printout depicted the month/year, total number of accidents, accidents occuring during weather conditions of sleet/snow, and accidents occuring on icy/snowy roads. This is considered the vital variable because it is expected that there is a direct relationship between icy roads, the mix/salt application rate, and the number of accidents that occur.

Accident severity was not taken into account. There were only 2 fatal accidents the 85/86 winter season and none this past winter on the sections of State Highway analyzed. None occured on icy roads. All accidents (Property damage only and Injury) were given the same weight. However if a fatal accident occured on a test section of State Highway where reduced salt usage was implemented, a copy of this fatal accident report is attached.

The number of snow/sleet storms requiring the use of either State equipment or contractor's equipment for the winter of 85/86 was 216 and for the winter of 86/87 was 217. The number of storms for each winter is approximately equal. However, the snow/sleet storms does vary with each District from (+22%) in District 7 to (-19%) in District 2.

ROUTE 128 - LEXINGTON/WALTHAM (HOBBS BROOK RESEVOIR AND STONY BROOK WATERSHED

There is a significant (95% confidence level) increase in the number of accidents that occured in the winter of 86/87 on icy/snowcovered roads when compared to the winter of 85/86. There was an increase from 5 to 10 accidents, a 100% increase in accidents. From the graph it is easy to view the increase in accidents.

ROUTE 28 (MAINS ST.) - N. READING

On this section of road there is also an increase in the number of accidents that occured during the second part of the comparison period. In the winter 85/86 there were 9 accidents on icy/snow covered roads while in the winter 86/87 there were 15 accidents on icy/snow covered roads. This is a 66% increase in accidents. This phenomenom is clearly evident from the accompanying graph.

ROUTE 123 - ABINGTON/ROCKLAND

The number of accidents on Route 123 in Abington in the winter of 85/86 was 1. This figure increased to 13 in the winter of 86/87. This is a significant increase. The number of storms in this section of the Commonwealth showed an +22% increase. Since the number of accidents on icy roads increased 1200%, the increase can not be attributed to the increase in storms.

ROUTE 138 - SOMERSET

A new deicing chemical (not reduced salt application rate) was utilized for this section of State Highway 3. Nevertheless there was a significant increase in the number of accidents on icy roads between the last two winter seasons. During the most recent winter there were seven (7) accidents on icy/snow covered roads on Route 138 in Somerset. A comparison to the next previous winter shows no accidents during the same time frame. A fatal accident on this stretch occured 3/16/86 but happened on a clear day with a dry pavement. It does not relate to this discussion.

HARRISON BLVD. - AVON

The number of accidents on Harrison Blvd. in Avon is the same for the previous two winters. Each winter there were 2 accidents. The number of storms for this area was also similar (+12%). Apparently the snow and ice policy for the most recent winter has no impact on the number of accidents occuring. A fatal accident occured in the 86/87 winter, but it occured on dry pavement.

ROUTE 12 - AUBURN

Accidents on icy/snow covered roads increased dramaticially from this winter to the previous year. There were 3 accidents in the winter of 85/86 compared to 10 during the 86/87 winter season. The increase of accidents is coupled with a 7% decrease in the number of storms. There was a fatal accident in October 1986. It was on a dry road on a clear day, thus no impact on the salt policy.

ROUTE 28 - AVON

During the winter of 85/86 there were 2 accidents on this section of State Highway when the road was icy or snow covered. This figure jumped to 10 in the winter of 86/87. The number of storms for this area of the Commonwealth during the two winters was similar (+12%). Since the frequency of storms increased 12% the 400% increase in accidents can not be attributed to this factor. There was a fatal accident on 4/20/86. It happened on a clear day on dry pavement. This accident does not impact on the analysis.

CONCLUSION

Seven sections of State Highways were analyzed by comparing accident data form October to May for two winter seasons. The 86/87 winter saw either reduced salt application rates or salt alternatives used. The data shows a significant increase in the number of accidents during the experimental salt/mix application rates on six of the seven locations. In total for all seven sections 22 accidents occured during the 85/86 winter, but 67 occured in 86/87. While the winter storms remained nearly equal. There is a direct relationship between the salt/mix application rates and the number of accidents on icy/snow covered roads. Reducing the application rate of salt/mix or utilizing salt alternatives increases (the probability of) accidents on icy/snow covered roads.

Robert L. Shea, P.E.
Traffic Engineer

TJS/ad

	1986			1987		
DISTRICT	NUMBER OF SNOW STORMS	NUMBER OF SLEET STORMS	TOTAL	NUMBER OF SNOW STORMS	NUMBER OF SLEET STORMS	TOTAL
1	32	3	35	26	4	30
2	18	8	26	16	5	21
3	24	3	27	22	3	25
4	16	13	29	16	11	27
5	20	2	23	23	3	26
6	18	6	24	23	4	27
7	17	10	27	19	14	33
8	26	0	26	20	8	28
TOTAL	171	45	216	165	52	217

NORTH READING - ROUTE 28(MAIN STREET)

MONTH/YEAR	TOTAL ACCIDENTS	WEATHER CONDITIONS SLEET/SNOW	ROAD CONDITIONS ICY/SNOW
OCT-1985 (1)	15	0	0
NOV-1985 (2)	27	5	3
DEC-1985 (3)	23	6	3
JAN 1986 (4)	10	0	0
FEB-1986 (5)	9	2	3
MAR-1986 (6)	15	0	0
APR-1986 (7)	10	0	0
MAY-1986 (8)	16	0	0
OCT-1986 (1)	7	0	0
NOV-1986 (2)	13	0	0
DEC-1986 (3)	24	6	7
JAN-1987 (4)	18	3	6
FEB-1987 (5)	10	1	2
MAR-1987 (6)	16	2	0
APR-1987 (7)	12	0	0
MAY-1987 (8)	26	0	0

LOW SALT COMPARISON

MOBILE READING - ROUTE 29

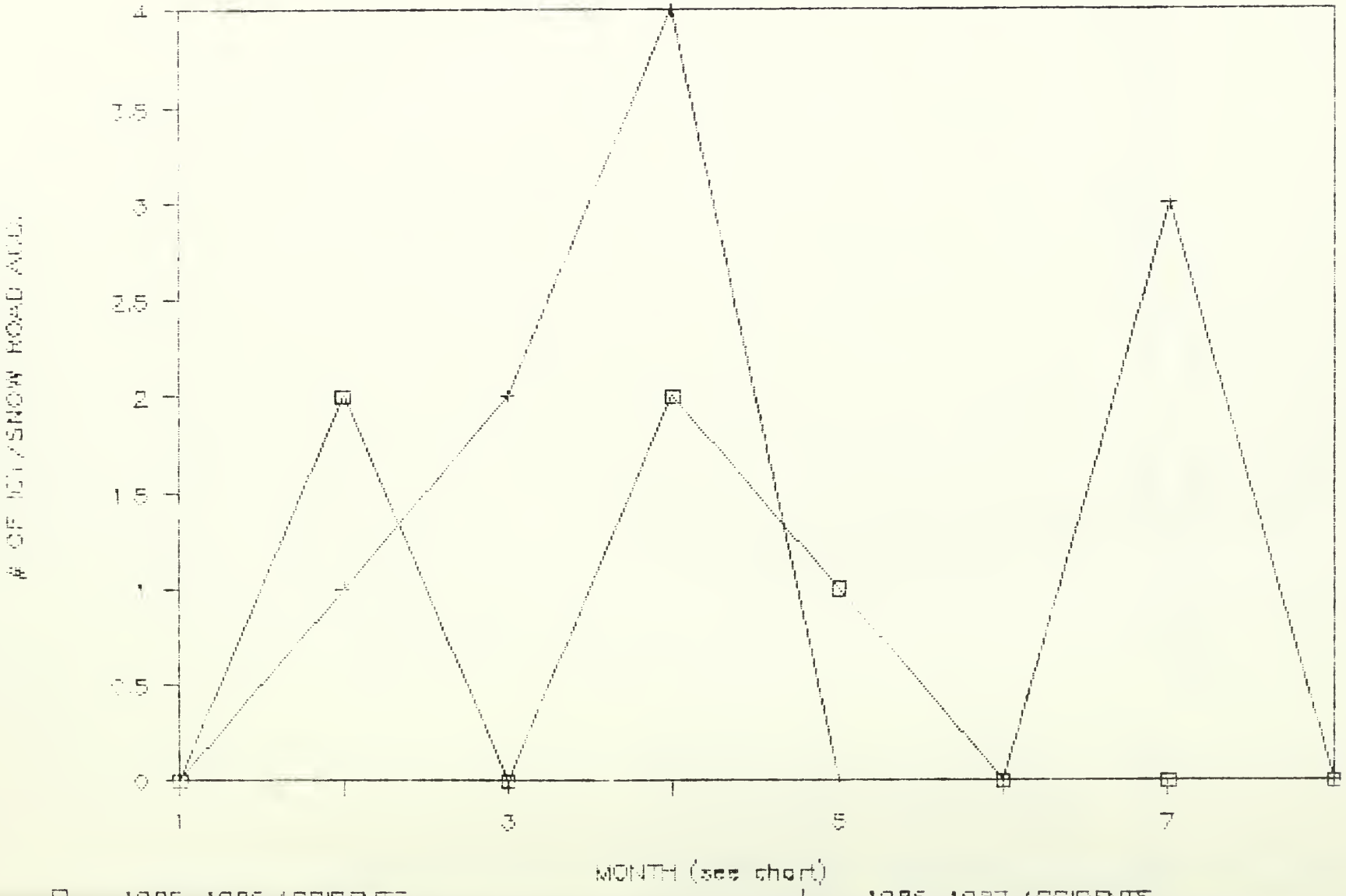
TRAFFIC OPERATION GROUP

LEXINGTON/WALTHAM - ROUTE 128

MONTH/YEAR	TOTAL ACCIDENTS	WEATHER CONDITIONS SLEET/SNOW	ROAD CONDITIONS ICY/SNOW
OCT-1985 (1)	9	0	0
NOV-1985 (2)	14	3	2
DEC-1985 (3)	10	0	0
JAN-1986 (4)	10	1	2
FEB-1986 (5)	9	3	1
MAR-1986 (6)	3	0	0
APR-1986 (7)	7	0	0
MAY-1986 (8)	11	0	0
OCT-1986 (1)	11	0	0
NOV-1986 (2)	7	0	1
DEC-1986 (3)	4	0	2
JAN-1987 (4)	14	3	4
FEB-1987 (5)	6	0	0
MAR-1987 (6)	9	0	0
APR-1987 (7)	9	3	3
MAY-1987 (8)	1	0	0

LOW SALT COMPARISON

LEXINGTON/WALTHAM – ROUTE 128



TRAFFIC OPERATION GROUP

ABINGTON/ROCKLAND - ROUTE 123

MONTH/YEAR	TOTAL ACCIDENTS	WEATHER CONDITIONS SLEET/SNOW	ROAD CONDITIONS ICY/SNOW
OCT-1985 (1)	17	0	0
NOV-1985 (2)	10	1	1
DEC-1985 (3)	16	0	0
JAN-1986 (4)	8	1	0
FEB-1986 (5)	6	0	0
MAR-1986 (6)	9	0	0
APR-1986 (7)	10	0	0
MAY 1986 (8)	11	0	0
OCT-1986 (1)	17	0	0
NOV-1986 (2)	21	2	1
DEC-1986 (3)	14	1	1
JAN-1987 (4)	26	10	6
FEB-1987 (5)	21	1	4
MAR-1987 (6)	19	0	1
APR-1987 (7)	9	0	0
MAY-1987 (8)	12	0	0

LOW SALT COMPARISON

ARLINGTON/ROCKLAND - ROUTE 123

TRAFFIC OPERATION GROUP

SOMERSET -- ROUTE 138

MONTH/YEAR	TOTAL ACCIDENTS	WEATHER CONDITIONS SLEET/SNOW	ROAD CONDITIONS ICY/SNOW
OCT-1985 (1)	20	0	0
NOV-1985 (2)	13	0	0
DEC-1985 (3)	18	0	0
JAN-1986 (4)	12	0	0
FEB-1986 (5)	9	0	0
MAR-1986 (6)	13	0	0
APR-1986 (7)	13	0	0
MAY-1986 (8)	25	2	0
OCT-1986 (1)	17	0	0
NOV-1986 (2)	11	0	0
DEC-1986 (3)	17	2	2
JAN-1987 (4)	22	5	5
FEB-1987 (5)	10	0	0
MAR-1987 (6)	8	0	0
APR-1987 (7)	19	0	0
MAY-1987 (8)	12	0	0

FATAL ACCIDENT

LOW SALT COMPARISON

SOMERSET - SALTED

TRAFFIC OPERATION GROUP

AVON - ROUTE 28

MONTH/YEAR	TOTAL ACCIDENTS	WEATHER CONDITIONS SLEET/SNOW	ROAD CONDITIONS ICY/SNOW
OCT-1985 (1)	13	0	0
NOV-1985 (2)	8	1	1
DEC-1985 (3)	6	3	1
JAN-1986 (4)	3	0	0
FEB-1986 (5)	6	0	1
MAR-1986 (6)	1	0	0
APR-1986 (7)*	8	0	0
MAY-1986 (8)	5	0	0
OCT-1986 (1)	6	0	0
NOV-1986 (2)	9	0	0
DEC-1986 (3)	7	1	0
JAN-1987 (4)	15	6	7
FEB-1987 (5)	7	2	2
MAR-1987 (6)	4	1	0
APR-1987 (7)	6	1	0
MAY-1987 (8)	9	0	0

* FATAL ACCIDENT

LOW SALT COMPARISON

SWOT - ROUTE 28

AUBURN -- ROUTE 12

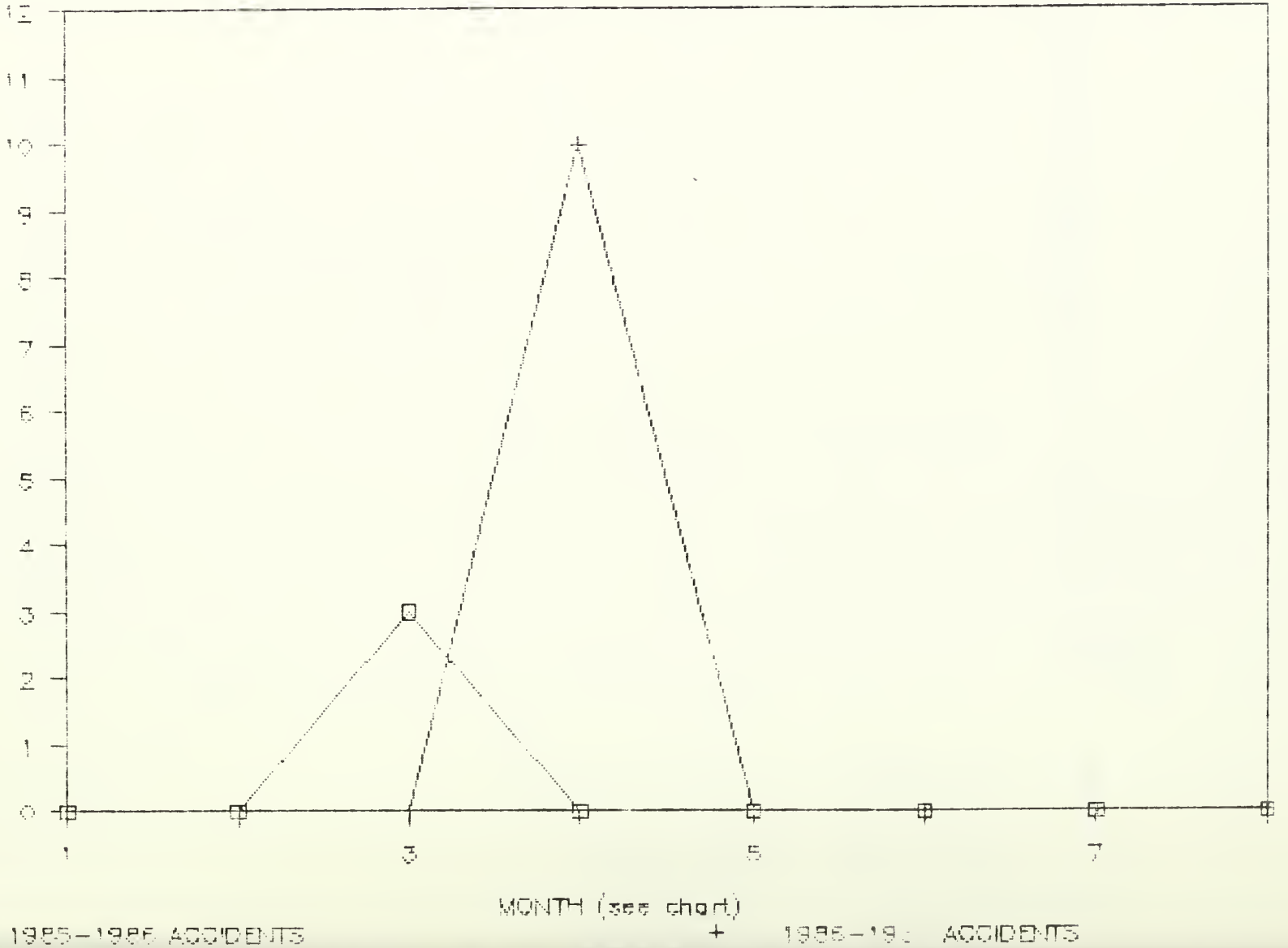
MONTH/YEAR	TOTAL ACCIDENTS	WEATHER CONDITIONS SLEET/SNOW	ROAD CONDITIONS ICY/SNOW
OCT-1985 (1)	7	0	0
NOV-1985 (2)	6	1	0
DEC-1985 (3)	10	0	3
JAN-1986 (4)	8	1	0
FEB-1986 (5)	6	0	0
MAR-1986 (6)	8	0	0
APR-1986 (7)	5	0	0
MAY-1986 (8)	7	0	0
OCT-1985 (1)*	10	0	0
NOV-1986 (2)	6	0	0
DEC-1985 (3)	11	2	0
JAN-1987 (4)	24	11	10
FEB-1987 (5)	13	2	0
MAR-1987 (6)	11	0	0
APR-1987 (7)	6	0	0
MAY-1987 (8)	12	0	0

FATAL ACCIDENT

TRAFFIC OPERATION GROUP

LOW SALT COMPARISON

AUBURN – ROUTE 12



TRAFFIC OPERATION GROUP

AVON - HARRISON BLVD.

MONTH/YEAR	TOTAL ACCIDENTS	WEATHER CONDITIONS SLEET/SNOW	ROAD CONDITIONS ICY/SNOW
OCT-1985 (1)	3	0	0
NOV-1985 (2)	2	0	0
DEC-1985 (3)	3	0	0
JAN-1986 (4)	3	0	1
FEB-1986 (5)	2	1	1
MAR-1986 (6)	3	0	0
APR-1986 (7)	1	0	0
MAY-1986 (8)	2	0	0
OCT-1986 (1)	2	0	0
NOV-1986 (2)	2	0	0
DEC-1986 (3)	2	0	0
JAN-1987 (4)*	4	1	1
FEB-1987 (5)	5	0	0
MAR-1987 (6)	5	1	1
APR-1987 (7)	8	0	0
MAY-1987 (8)	1	0	0

* FATAL ACCIDENT

LOW SALT COMPARISON

AVON - HARRISON BLVD.

TRAFFIC OPERATION GROUP

Appendix C
Water Analysis Data

APPENDIX C

LOW SALT DATA
(WATER SUPPLY)

District 2

1	Pelham & Belchertown	(Route 202 &
2	Granby	(Route 202)
3	Athol	(Route 2A)
4	Goshen	(Route 9)
5	Cummington	(Route 9 - 112)
6	Orange	(Route 2)

District 3

1	Oxford *	(Route 12)
2	Brimfield	(Route 19)
3	Sutton	(
4	Southborough *	(Route 30)

District 4

1	Reading	(Route 28)
2	Cambridge	(Route 128)

District 5

1	Salisbury	(Route 1A)

District 6

1	Avon & Brockton	(Route 28 & 9)
2	Westwood *	(Blue Hill Dr.)
3	Foxborough *	(Route 140)
4	Acushnet & Fairhaven *	(S. Main Street)
5	Taunton & Berkley *	(County Road)
6	Somerset	(Route 138)

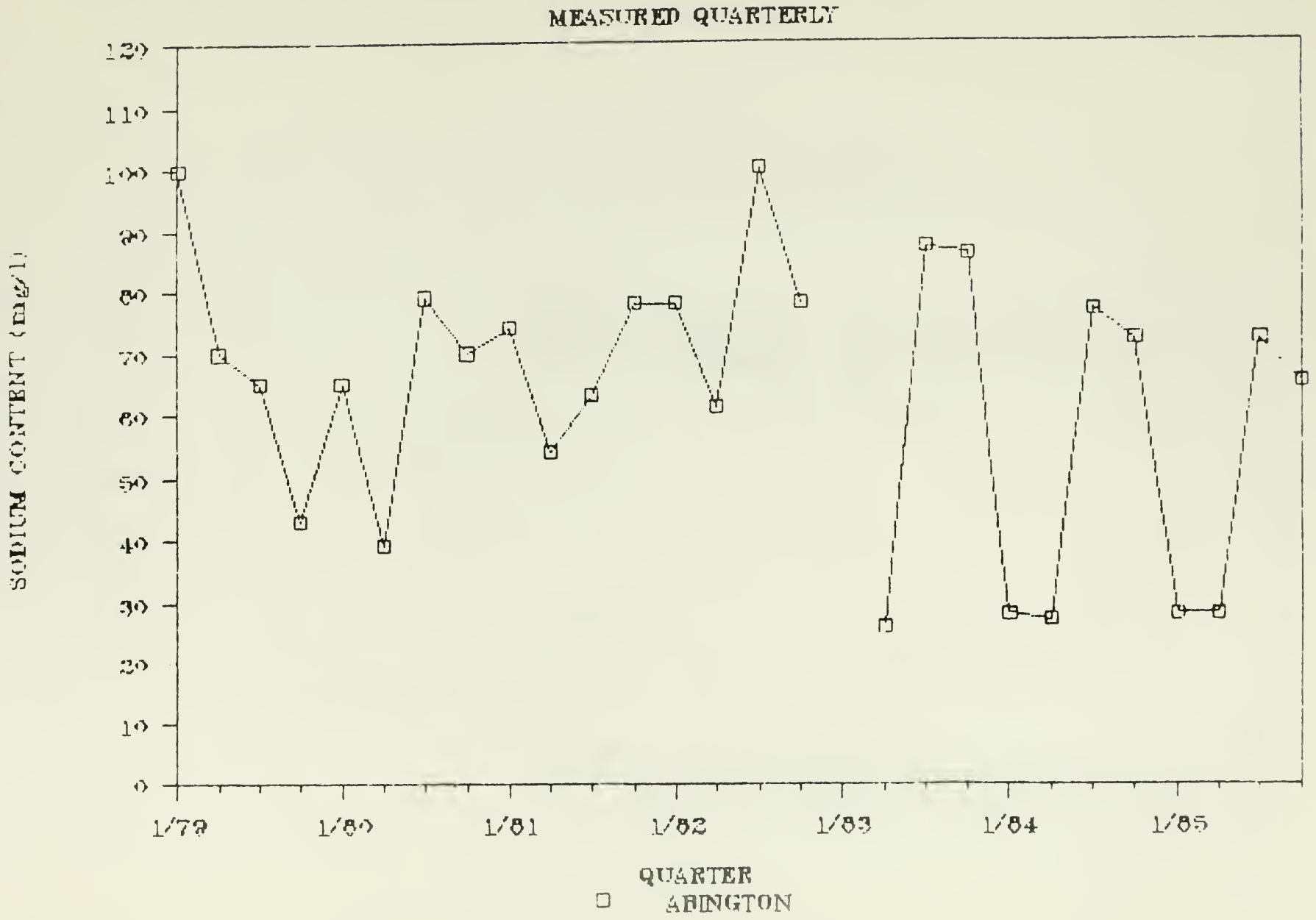
District 7

1	Abington	(Routes 18 & 123)

NOTE: The ones underlined are available from DEQE

* This location was not included in the 1986-1987 salt reduction program.

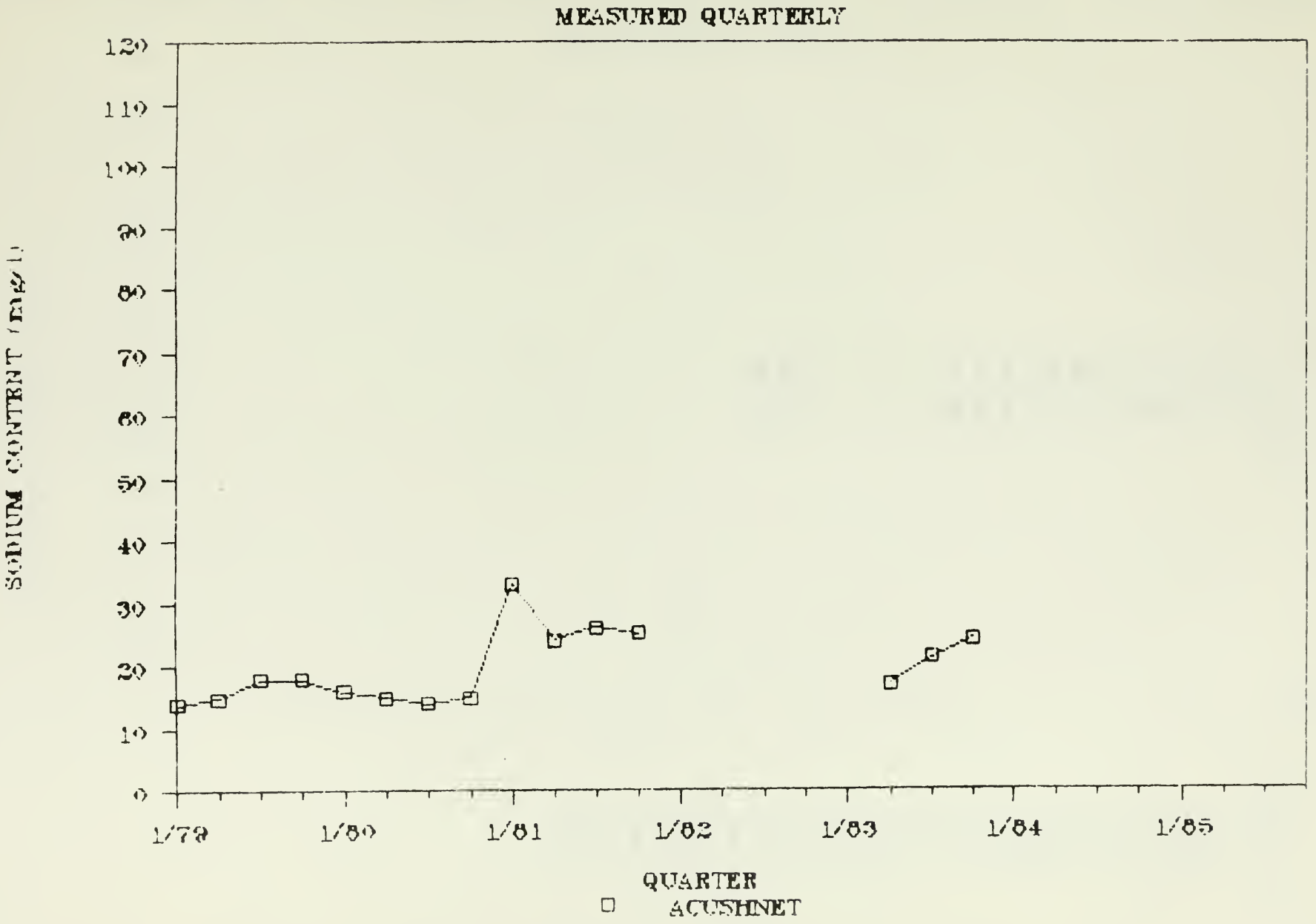
SODIUM CONTENT IN PUBLIC WATER SUPPLIES



CONCENTRATION OF SODIUM IN PUBLIC WATER SUPPLIES (mg/l)

Quarter	Abington
1/79	100.00
2/79	70.00
3/79	65.00
4/79	43.00
1/80	65.00
2/80	39.00
3/80	79.00
4/80	70.00
1/81	74.00
2/81	54.00
3/81	63.00
4/81	78.00
1/82	78.00
2/82	61.00
3/82	100.00
4/82	78.00
1/83	
2/83	26.00
3/83	87.00
4/83	86.00
1/84	28.00
2/84	27.00
3/84	77.00
4/84	72.00
1/85	28.00
2/85	28.00
3/85	72.00
4/85	65.00

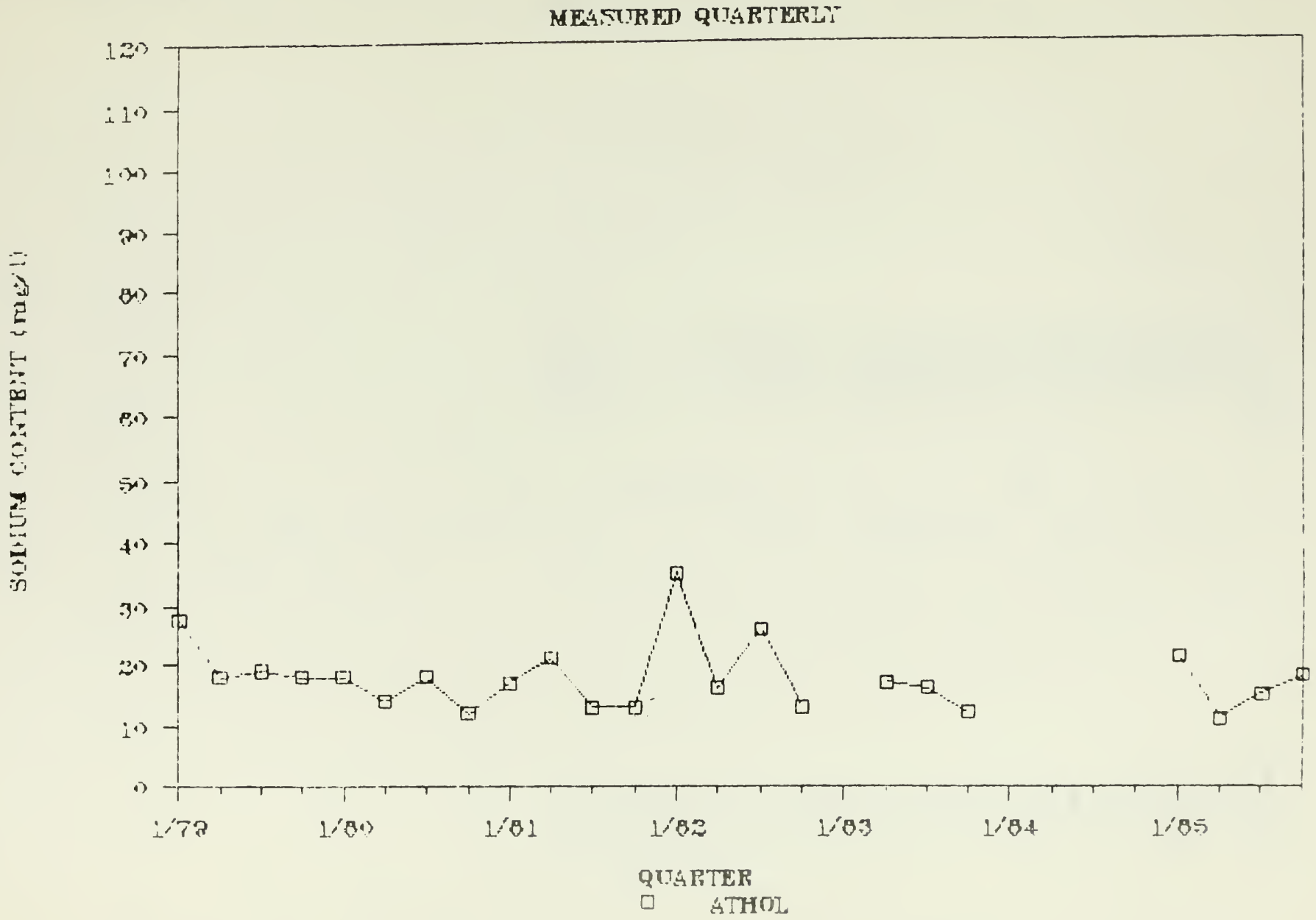
SODIUM CONTENT IN PUBLIC WATER SUPPLIES



CONCENTRATION OF SODIUM IN PUBLIC WATER SUPPLIES (mg/l)

Quarter	Acushnet
1/79	14.00
2/79	15.00
3/79	18.00
4/79	18.00
1/80	16.00
2/80	15.00
3/80	14.00
4/80	15.00
1/81	33.00
2/81	24.00
3/81	26.00
4/81	25.00
1/82	
2/82	
3/82	
4/82	
1/83	
2/83	17.00
3/83	21.00
4/83	24.00
1/84	
2/84	
3/84	
4/84	
1/85	
2/85	
3/85	
4/85	

SODIUM CONTENT IN PUBLIC WATER SUPPLIES

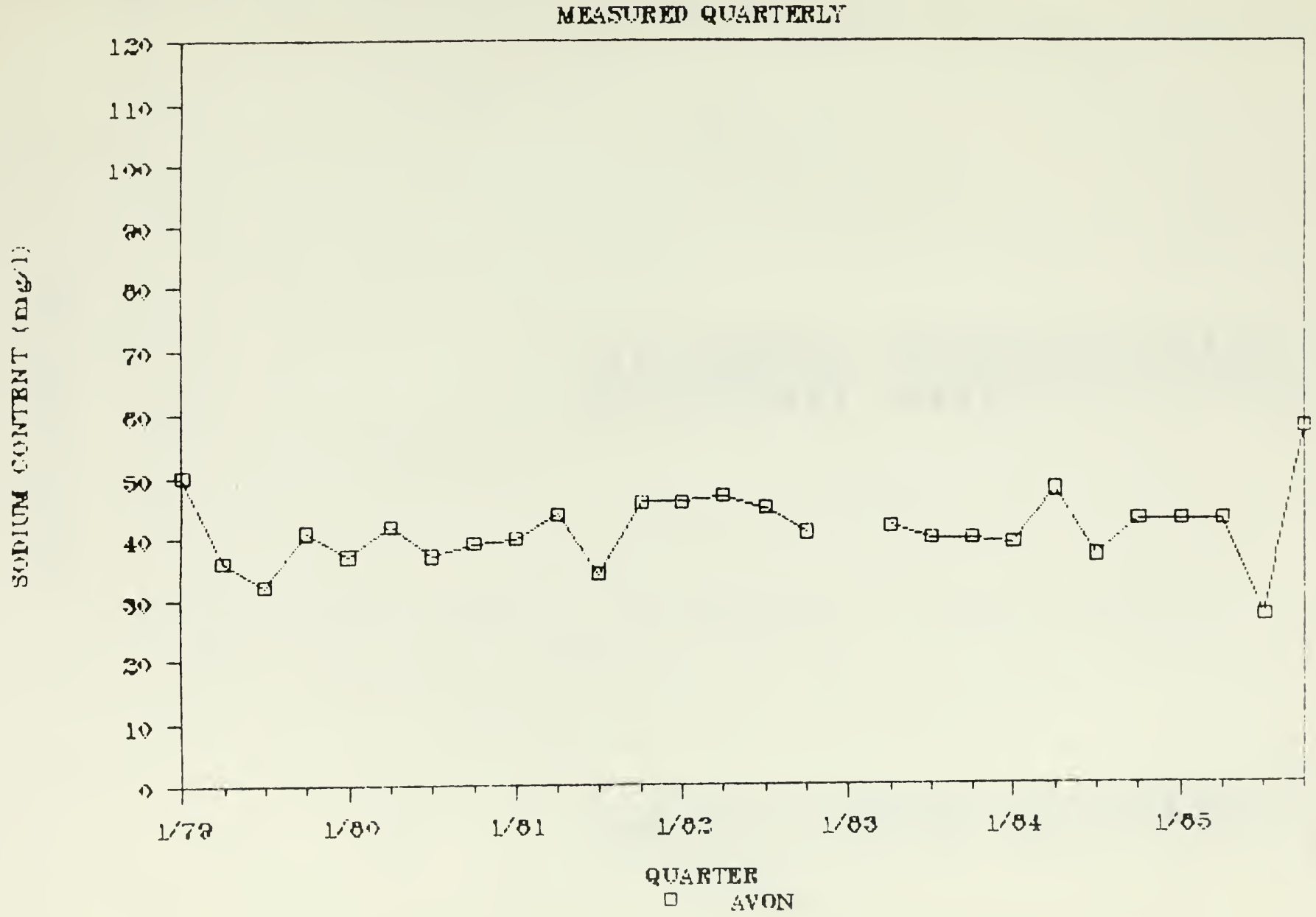


CONCENTRATION OF SODIUM IN PUBLIC WATER SUPPLIES (mg/l)

Quarter	Athol
1/79	28.00
2/79	18.00
3/79	19.00
4/79	18.00
1/80	18.00
2/80	14.00
3/80	18.00
4/80	12.00
1/81	17.00
2/81	21.00
3/81	13.00
4/81	13.00
1/82	35.00
2/82	16.00
3/82	26.00
4/82	13.00
1/83	
2/83	17.00
3/83	16.00
4/83	12.00
1/84	
2/84	
3/84	
4/84	
1/85	21.00
2/85	11.00
3/85	15.00
4/85	18.00

SODIUM CONTENT

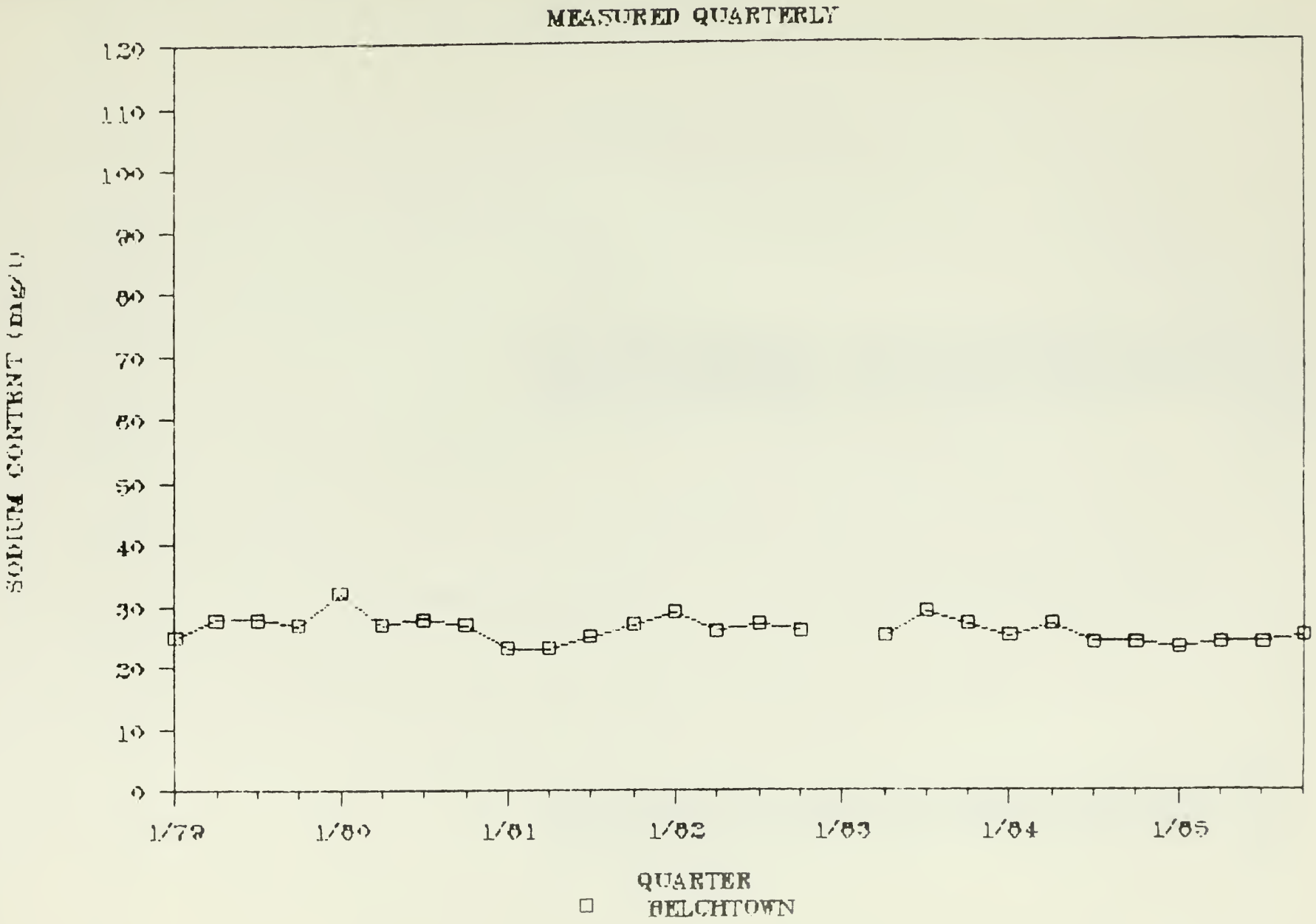
SODIUM CONTENT IN PUBLIC WATER SUPPLIES



CONCENTRATION OF SODIUM IN PUBLIC WATER SUPPLIES (mg/l)

Quarter	Avon
1/79	50.00
2/79	36.00
3/79	32.00
4/79	41.00
1/80	37.00
2/80	42.00
3/80	37.00
4/80	39.00
1/81	40.00
2/81	44.00
3/81	34.00
4/81	46.00
1/82	46.00
2/82	47.00
3/82	45.00
4/82	41.00
1/83	
2/83	42.00
3/83	40.00
4/83	40.00
1/84	39.00
2/84	48.00
3/84	37.00
4/84	43.00
1/85	43.00
2/85	43.00
3/85	27.00
4/85	58.00

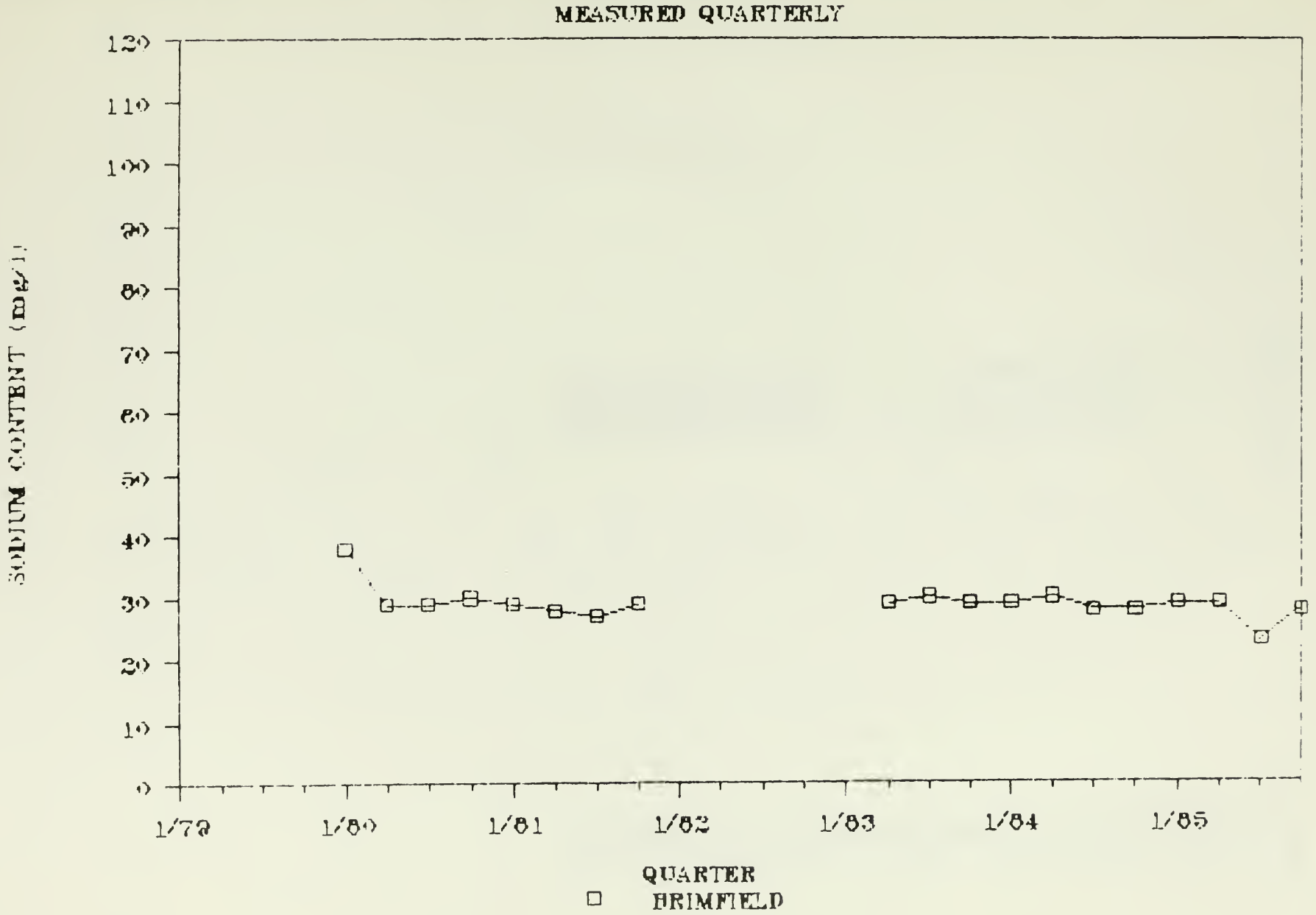
SODIUM CONTENT IN PUBLIC WATER SUPPLIES



CONCENTRATION OF SODIUM IN PUBLIC WATER SUPPLIES (mg/l)

Quarter	Belch-town
1/79	25.00
2/79	28.00
3/79	28.00
4/79	27.00
1/80	32.00
2/80	27.00
3/80	28.00
4/80	27.00
1/81	23.00
2/81	23.00
3/81	25.00
4/81	27.00
1/82	29.00
2/82	26.00
3/82	27.00
4/82	26.00
1/83	
2/83	25.00
3/83	29.00
4/83	27.00
1/84	25.00
2/84	27.00
3/84	24.00
4/84	24.00
1/85	23.00
2/85	24.00
3/85	24.00
4/85	25.00

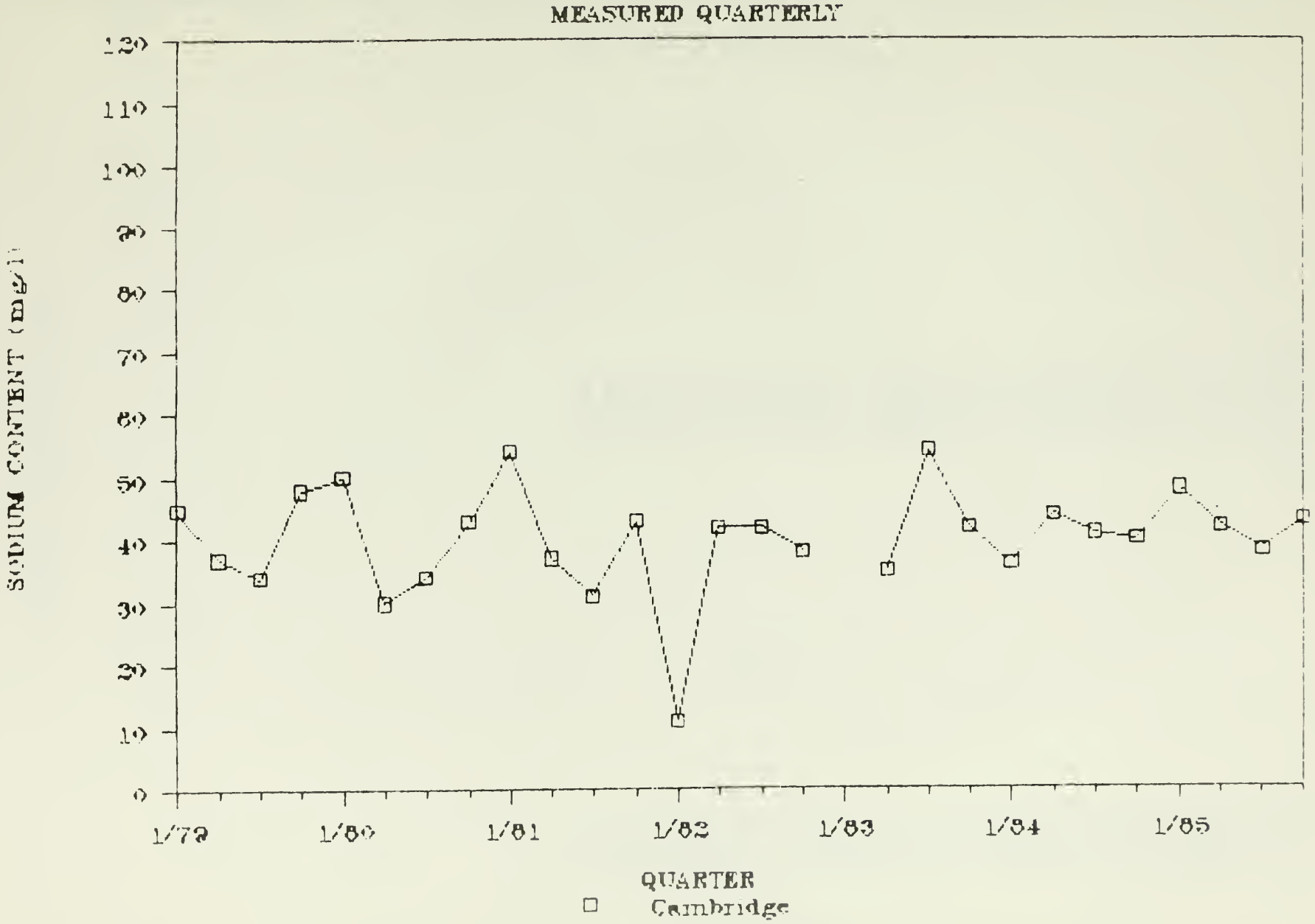
SODIUM CONTENT IN PUBLIC WATER SUPPLIES



CONCENTRATION OF SODIUM IN PUBLIC WATER SUPPLIES (mg/l)

Quarter	Brimfield
1/79	
2/79	
3/79	
4/79	
1/80	38.00
2/80	29.00
3/80	29.00
4/80	30.00
1/81	29.00
2/81	28.00
3/81	27.00
4/81	29.00
1/82	
2/82	
3/82	
4/82	
1/83	
2/83	29.00
3/83	30.00
4/83	29.00
1/84	29.00
2/84	30.00
3/84	28.00
4/84	28.00
1/85	29.00
2/85	29.00
3/85	23.00
4/85	28.00

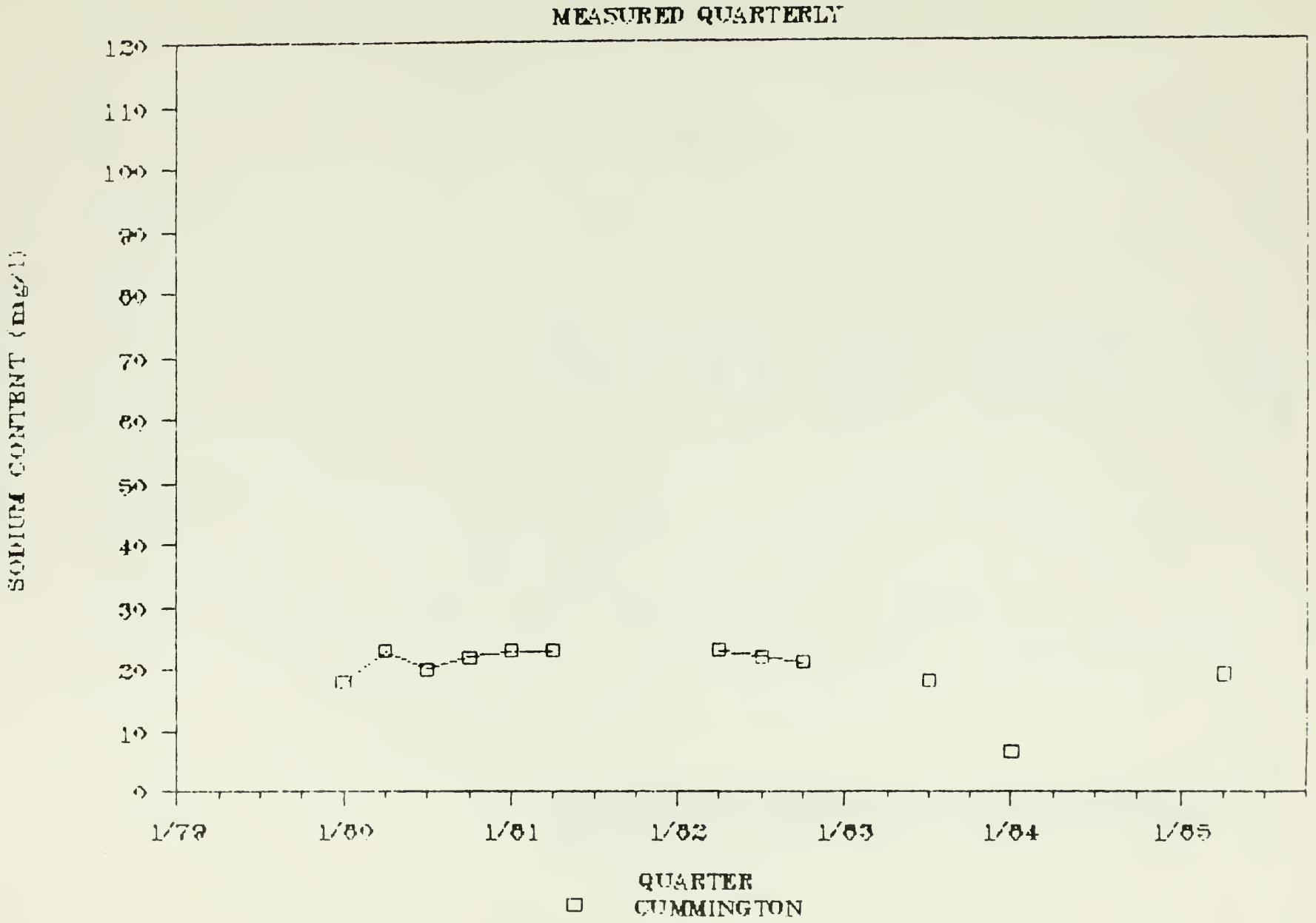
SODIUM CONTENT IN PUBLIC WATER SUPPLIES



CONCENTRATION OF SODIUM IN PUBLIC WATER SUPPLIES (mg/l)

Quarter	Cambridge
1/79	45.00
2/79	37.00
3/79	34.00
4/79	48.00
1/80	50.00
2/80	30.00
3/80	34.00
4/80	43.00
1/81	54.00
2/81	37.00
3/81	31.00
4/81	43.00
1/82	11.00
2/82	42.00
3/82	42.00
4/82	38.00
1/83	
2/83	35.00
3/83	54.00
4/83	42.00
1/84	36.00
2/84	44.00
3/84	41.00
4/84	40.00
1/85	48.00
2/85	42.00
3/85	38.00
4/85	43.00

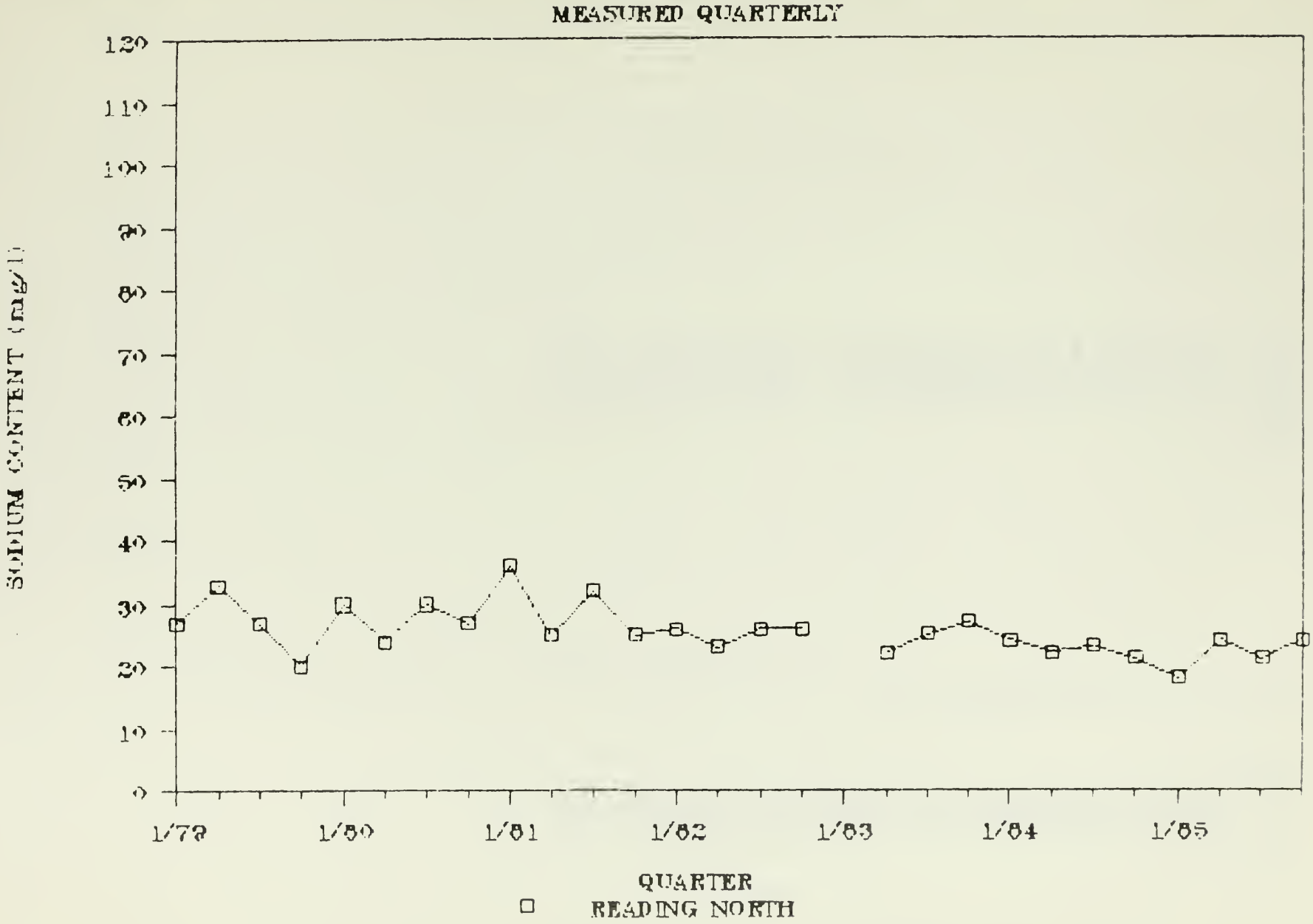
SODIUM CONTENT IN PUBLIC WATER SUPPLIES



CONCENTRATION OF SODIUM IN PUBLIC WATER SUPPLIES (mg/l)

Quarter	Cumming-ton
1/79	
2/79	
3/79	
4/79	
1/80	18.00
2/80	23.00
3/80	20.00
4/80	22.00
1/81	23.00
2/81	23.00
3/81	
4/81	
1/82	
2/82	23.00
3/82	22.00
4/82	21.00
1/83	
2/83	
3/83	18.00
4/83	
1/84	6.60
2/84	
3/84	
4/84	
1/85	
2/85	19.00
3/85	
4/85	

SODIUM CONTENT IN PUBLIC WATER SUPPLIES

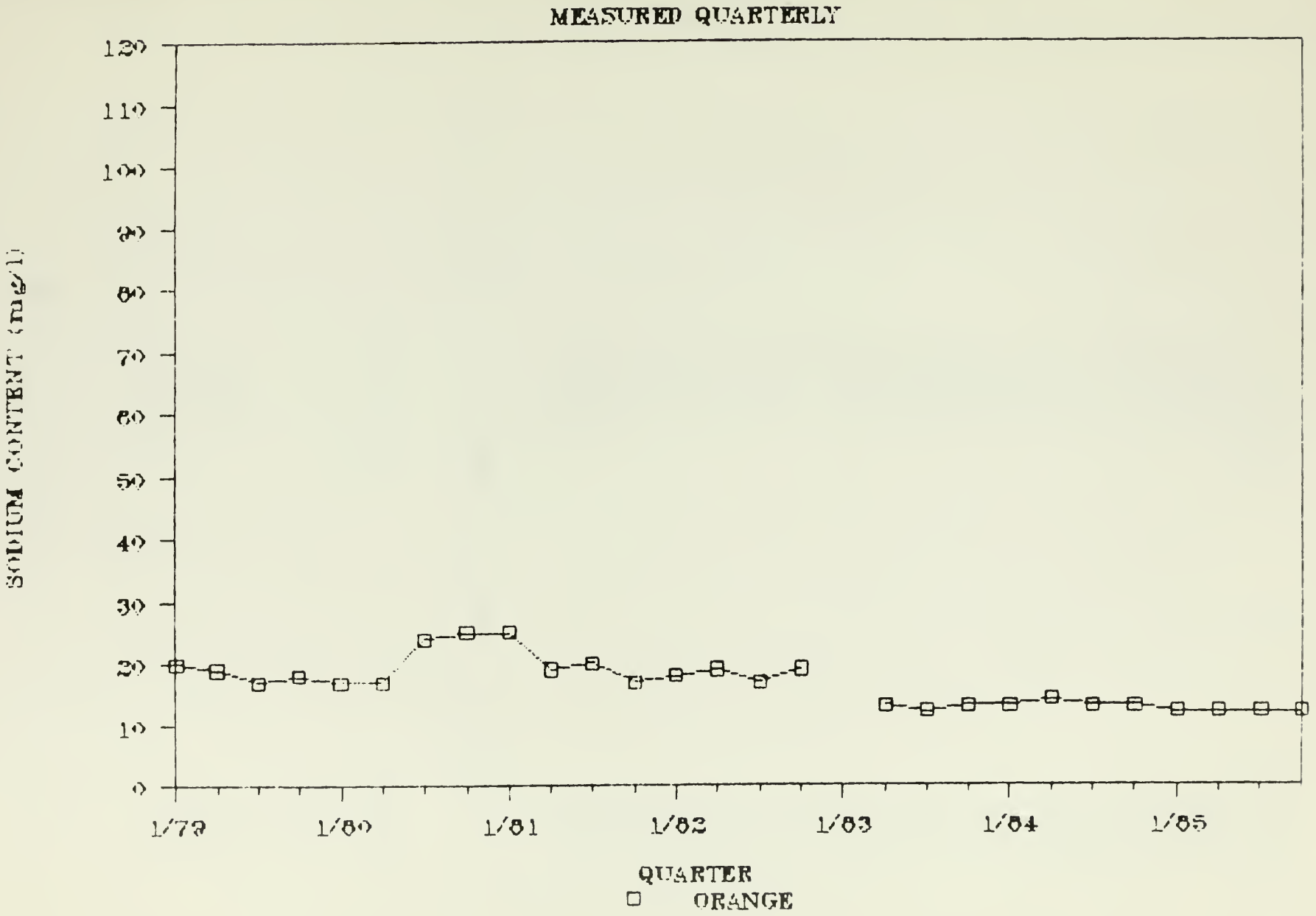


CONCENTRATION OF SODIUM IN PUBLIC WATER SUPPLIES (mg/l)

Quarter	Reading North
1/79	27.00
2/79	33.00
3/79	27.00
4/79	20.00
1/80	30.00
2/80	24.00
3/80	30.00
4/80	27.00
1/81	36.00
2/81	25.00
3/81	32.00
4/81	25.00
1/82	26.00
2/82	23.00
3/82	26.00
4/82	26.00
1/83	
2/83	22.00
3/83	25.00
4/83	27.00
1/84	24.00
2/84	22.00
3/84	23.00
4/84	21.00
1/85	18.00
2/85	24.00
3/85	21.00
4/85	24.00

SODIUM CONTENT

SODIUM CONTENT IN PUBLIC WATER SUPPLIES



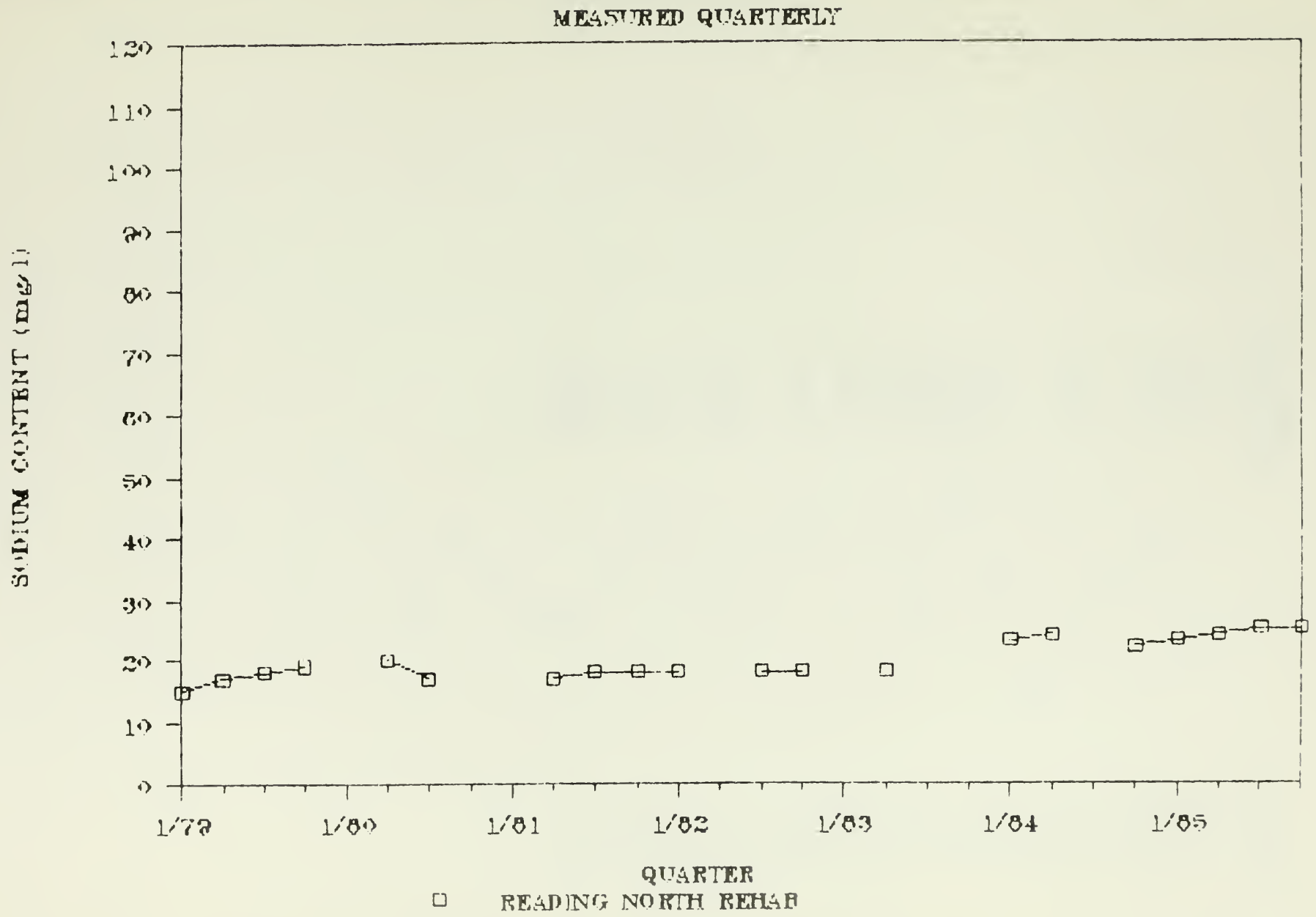
CONCENTRATION OF SODIUM IN PUBLIC WATER SUPPLIES (mg/l)

Quarter	Orange
1/79	20.00
2/79	19.00
3/79	17.00
4/79	18.00
1/80	17.00
2/80	17.00
3/80	24.00
4/80	25.00
1/81	25.00
2/81	19.00
3/81	20.00
4/81	17.00
1/82	18.00
2/82	19.00
3/82	17.00
4/82	19.00
1/83	
2/83	13.00
3/83	12.00
4/83	13.00
1/84	13.00
2/84	14.00
3/84	13.00
4/84	13.00
1/85	12.00
2/85	12.00
3/85	12.00
4/85	12.00

CONCENTRATION OF SODIUM IN PUBLIC WATER SUPPLIES (mg/l)

Quarter	Brimfield
1/79	
2/79	
3/79	
4/79	
1/80	38.00
2/80	29.00
3/80	29.00
4/80	30.00

SODIUM CONTENT IN PUBLIC WATER SUPPLIES

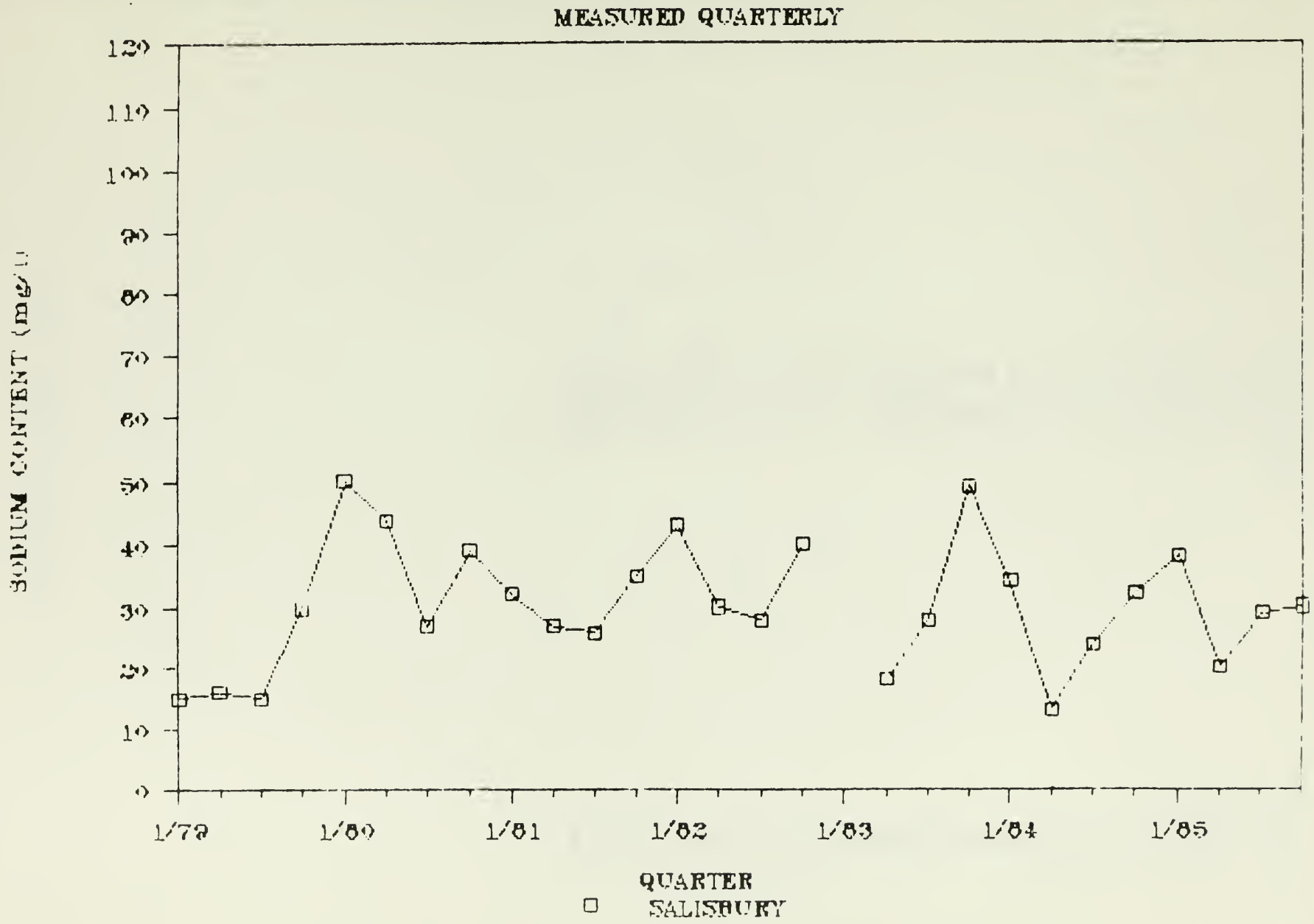


CONCENTRATION OF SODIUM IN PUBLIC WATER SUPPLIES (mg/l)

Quarter	Reading North Reh
1/79	15.00
2/79	17.00
3/79	18.00
4/79	19.00
1/80	
2/80	20.00
3/80	17.00
4/80	
1/81	
2/81	17.00
3/81	18.00
4/81	18.00
1/82	18.00
2/82	
3/82	18.00
4/82	18.00
1/83	
2/83	18.00
3/83	
4/83	
1/84	23.00
2/84	24.00
3/84	
4/84	22.00
1/85	23.00
2/85	24.00
3/85	25.00
4/85	25.00

SODIUM CONTENT

SODIUM CONTENT IN PUBLIC WATER SUPPLIES

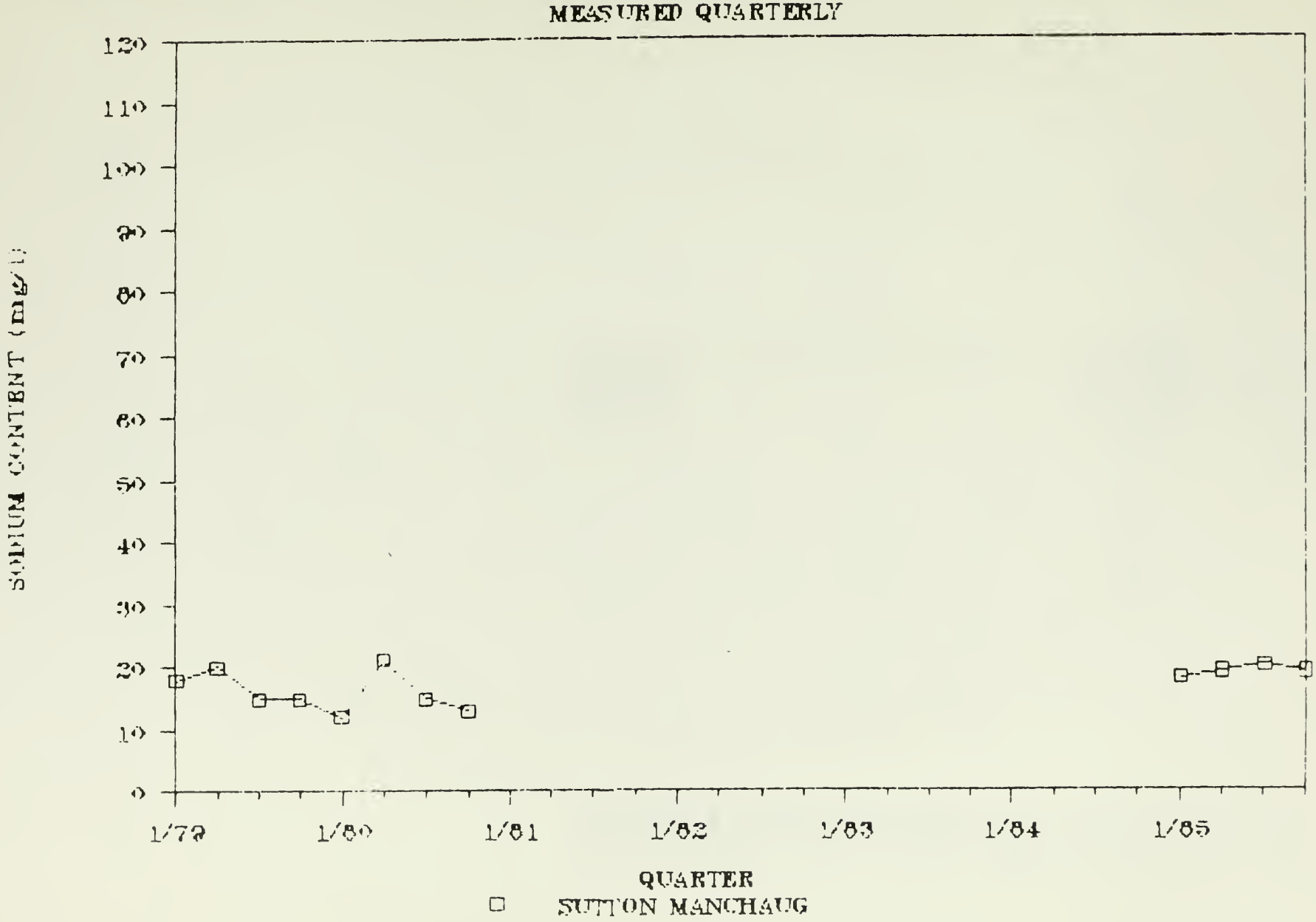


CONCENTRATION OF SODIUM IN PUBLIC WATER SUPPLIES (mg/l)

Quarter	Westwood
1/79	
2/79	
3/79	73.00
4/79	75.00
1/80	
2/80	
3/80	
4/80	
1/81	27.00
2/81	61.00
3/81	77.00
4/81	87.00
1/82	72.00
2/82	36.00
3/82	26.00
4/82	43.00
1/83	
2/83	
3/83	
4/83	
1/84	
2/84	
3/84	
4/84	
1/85	26.00
2/85	29.00
3/85	
4/85	28.00

SODIUM CONTENT

SODIUM CONTENT IN PUBLIC WATER SUPPLIES



CONCENTRATION OF SODIUM IN PUBLIC WATER SUPPLIES (mg/l)

Quarter	Sutton Manchaug
1/79	18.00
2/79	20.00
3/79	15.00
4/79	15.00
1/80	12.00
2/80	21.00
3/80	15.00
4/80	13.00
1/81	
2/81	
3/81	
4/81	
1/82	
2/82	
3/82	
4/82	
1/83	
2/83	
3/83	
4/83	
1/84	
2/84	
3/84	
4/84	
1/85	18.00
2/85	19.00
3/85	20.00
4/85	19.00

Appendix D
Sample District Reporting Forms

MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

LOW SALT EVALUATION

Foreman's Report

Load and Spreading Data

Foreman: C A. Pinto

Spreader Route: 6

Maint Gang: 08 Yarmouth

Time:

Date: Jan. 26-27-1987

A. LOAD: 50% sand/ 50% salt @ 300 #/lane mile

B. WEATHER: Snowing —

Temp: 24°-29° °C

Wind: Moderate 13-22 mph
strong - 23-30 MPH

Precipitation Description: WET, (DRY), (BLOWING SNOW), CLEAR
(Circle appropriate Description) FREEZING RAIN, SLEET, MIXED SNOW/RAIN

Time Precipitation Began:

C. SPREAD DATA: Monday - 01-26-87

Time Spreading Began 4:30AM -

Lane miles spread All of Rte 6 - Barnstable To Orleans

Spreader Type Automatic Spreaders

Width of Pattern

D. RESULTS:

Overall opinion of MIX ____ FAVORABLE ___X___ UNFAVORABLE

Condition of Surface ____ WET ___X___ SLUSHY ___X___ PACK

Traffic Operations ____ NORMAL ___X___ SLOW ___X___ SKIDDING

E. COMMENTS:

Heavy Snow Sanded As Conditions Required.
Road Conditions After Spreading Sand & Salt Mealy - & Snow
Packed On Hwy. Called Sander After It Started Snowing
Roads Were Slippery. Called Plows To Plow Snow Off Hwy.
After Storm Was Over Rte Mid Cape Hwy Had Snow Pack
Sanded Hwy. After Morning Thaw Called Plows To Slush off
Rds - Resanded After Plowing - Last of Snow Pack Remove
(over)

From Rte 6 Mid Cape Hwy [illegible]

Used 50/50 Mix.

New Snow + Ice Policy - Not Working To Well, Received Many Complaints.

THE COMMONWEALTH OF MASSACHUSETTS

INTER OFFICE CORRESPONDENCE — DEPARTMENT OF PUBLIC WORKS

From C. Chisse

Attention of Stephen Soares, S & I Engineer ..... 1/28/ 19 87

Subject Storm Report Cape Cod - Low Salt Routes — SHEET 1 OF 6

TIME AND DATE STORM START: 3 AM 1/26/87

TIME AND DATE STORM END: 11 PM 1/27/87

TOTAL ACCUMULATION: 14" - 18"

AREA OBSERVED:

CANAL TO RTE. 132 ✓ RTE. 132 TO PROVINCETOWN ____

AVERAGE TEMPERATURE: START 25°

MIDDLE 30°

END 23°

PAVEMENT CONDITIONS AT START OF STORM: DRY No Frost in Ground

TYPE OF PRECIPITATION: Moderate and Heavy Snow -

OBSERVATIONS: (Make sure all additional applications are documented; comparisons to 1-1 routes; accidents # and type, if possible).

Falmouth Avoided Severe "Pack" Problems Through Extensive Plowing Made Possible By Borrowing Plows From Other Sections.

However, Packed Snow Did Exist On All Roads (Both 50/50 and 4 to 1 Sections) After The Storm Was Over.

The Pack Was Worked During Normal Work Hours With The 4 to 1 Sections Taking From 2 to 5 Hours Longer To Clean Than The 50/50 Sections.

ADM-320

STORM REPORT CAPE COD - LOW SALT ROUTES (CONTINUED)

I HAVE ATTACHED SUMMARIES OF SALT USED, NOT INCLUDING SPOT SANDING OPERATIONS.

TEMPERATURES WERE LOW AND THE SNOW [illegible] OF THE STORM WITH RAPID ACCUMULATION. PLOWS WERE OUT EARLY AND SALT APPLICATIONS WERE MAINLY TO KEEP THE SALT IN A plowable STATE.

ALL AREAS (50/50 AND 4 TO 1) WERE WHITE DURING THE STORM AND REMAINED WHITE WELL AFTER THE STORM HAD ENDED. THE DIFFERENCE IN THE TWO AREAS WAS NOTED DURING THE FOLLOWING WORK DAY WHEN THE 4 TO 1 SECTIONS REQUIRED MORE TIME TO REMOVE THE PACK.

STATISTICS FOR THIS STORM

	TOTAL SALT	LANE MI.	AVG. #/LN.
4 TO 1	87,696	124.2	230.3
50/50	250,560	129.8	1930.4

SNOWFALL HAD COMPLETELY STOPPED BY APPROX. 1 AM. THE BRIGHT SUNSHINE IN THE MORNING WAS A PROMINENT FACTOR IN ELIMINATING THE PACK.

SUMMARY

THE STORM OF JAN. 26 & 27 WAS A MAJOR STORM CAUSING SNOW ACCUMULATIONS OF 14" TO 18" IN SECTIONS 6 & 7. THE SNOW WAS ACCOMPANIED BY HIGH WINDS [illegible]

THERE WERE NUMEROUS CARS OFF THE ROAD DURING THE DAYLIGHT HOURS OF THE 26TH BUT I DON'T OBSERVE ANY VEHICLE TO VEHICLE ACCIDENTS OR PERSONAL INJURY.

I BELIEVE THERE WERE TWO MAJOR FACTORS FOR NOT HAVING A MORE SEVERE PACK PROBLEM.

(1) TRAFFIC WAS ALMOST NON-EXISTENT DURING THE EVENING AND THROUGH THE NIGHT. THIS MEANT THE SNOW WASN'T BEING PACKED DOWN AND I ALLOWED THE PLOWS TO TRAVEL BACK AND FORTH IN THEIR LANES WITHOUT INTERFERENCE.

(2) THE MORNING SUN PROBABLY WAS MORE OF A FACTOR THAN THE SALT IN KEEPING THE ROADS PLOWABLE ON THE 27TH.

NOTE: FALMOUTH WAS AIDED BY ADDITIONAL PLOWS FROM OTHER SECTIONS.

STORM REPORT CAPE COD - LOW SALT ROUTES (CONTINUED)

FALMOUTH GANG 6

SANDER ROUTE 1 23 LN. MI.

4 TO 1 14 APPLICATIONS TOTAL MATERIAL 42 YDS.

TOTAL SALT USED FOR STORM 18,144# 799#/LANE MI

SANDER ROUTE 2 25 LN. MI.

4 TO 1 16 APPLICATIONS TOTAL MATERIAL 48 YDS.

TOTAL SALT USED FOR STORM 20,736# 829#/LANE MI.

SANDER ROUTE 3 26.7 LN. MI.

50/50 23 APPLICATIONS TOTAL MATERIAL 69 YDS.

TOTAL SALT USED FOR STORM 74,520# 2791#/LANE MI.

SANDER ROUTE 4 25.1 LN. MI.

50/50 20 APPLICATIONS TOTAL MATERIAL 60 YDS

TOTAL SALT USED FOR STORM 64,800# 2582#/LANE MI

SANDER ROUTE 5 16.2 LN. MI.

4 TO 1 8 APPLICATIONS TOTAL MATERIAL 16 YDS

TOTAL SALT USED FOR STORM 6912# 427#/LANE MI

STORM REPORT CAPE COD - LOW SALT ROUTES (CONTINUED)

SANDWICH GANG 7

SANDER ROUTE 3 12 LN. MI.

50/50 4 APPLICATIONS TOTAL MATERIAL 18 YDS

TOTAL SALT USED FOR STORM 19,440# 1620#/LN. MI.

50/50 SANDER ROUTE 4 24 LN. MI.
6 APPLICATIONS 29 YDS.
TOTAL SALT USED FOR STORM 31,320# 1305#/LN. MI.

4 TO 1 SANDER ROUTE 5 32 LN. MI.
4 APPLICATIONS 46 YDS
TOTAL SALT USED FOR STORM 19,872 621#/LN. MI.

4 TO 1 SANDER ROUTE 7 12 LN. MI.
5 APPLICATIONS 23 YDS.
TOTAL SALT USED FOR STORM 9,936 828#/LN. MI.

STORM REPORT CAPE COD - LOW SALT ROUTES (CONTINUED)

BARNSTABLE GANG 7

50/50 SANDER ROUTE 1 22 LN. MI

5 APPLICATIONS TOTAL MATERIAL 29 Yd's

TOTAL SALT USED FOR STORM 31,320# 1424#/LN. MI.

50/50 SANDER ROUTE 2 20 LN. MI.

6 APPLICATIONS TOTAL MATERIAL 27 Yd's

TOTAL SALT USED FOR STORM 29,160# 1458#/LN. MI.

4 TO 1 SANDER ROUTE 6 16 LN. MI.

5 APPLICATIONS TOTAL MATERIAL 28 Yd's

TOTAL SALT USED FOR STORM 12,096# 756#/LN. MI.

Appendix E
Public Information Material

HARVARD CRIMSON
HARVARD UNIVERSITY
CAMBRIDGE, MA
D. 5.000
19
MAR 23 1987

NEW ENGLAND NEWSCLIP AGENCY, INC

State Rep. Wants Reservoir Clean-Up

MDPW

By ELSA C. ARNETT

A Cambridge state representative has sponsored legislation to reduce the contamination of local reservoir water, aides said yesterday.

The bill proposed by State Rep. Charles F. Flaherty Jr. (D-Cambridge) would require the Massachusetts Department of Public Works (DPW) to redirect a drainage pipe running from three major roadways into the Cambridge Reservoir.

The drainage water pollutes the water with salt and other possibly harmful substances, said one of Flaherty's research assistants.

Flaherty is sponsoring legislation to clean up the water because he thinks it is an important health issue for the community, said his assistant. The Cambridge Reservoir provides 17 million gallons of water per day to residents of the city.

But the DPW opposes the bill. Officials there said that redirecting the drainage pipe is just one answer to the problem, and not neccessarily the best.

At present, a drainage pipe transfers materials from three state highway routes, 128, 2, and 2A, directly into the Hobbs Brook (Cambridge) Reservior, said Flaherty's assistant.

There is community concern about this drainage, she said, because many unhealthful substances are filtered into this water.

"Road salt for winter highway maintainence, parking lot dust, and vehicle exhausts contribute to potentially hazardous materials in the water," said Flaherty's assistant.

Cambridge's reservior currently has been measured to have 50 milligrams of sodium per liter, she said. The recommended standard for those persons under sodium restricted diets perscribes that water containing over 20 miligrams of sodium per liter, should not be consumed, she said.

This problem has been accentuated recently, because the large number of "ice storms and wet snow storms" during the winters of 1983/84 and 1984/85 required that increased applications of salt were necessary, she said.

The Bill

The bill proposes that the DPW find a way of redirecting the drainage pipe so that it will not flow into the Cambridge Reservoir and risk contaminating the water.

If passed, the bill will go into effect on Dec. 31, 1988, when no street or highway drainage under the control of the DPW will be discharged directly into the Cambridge Reservoir or onto any land area within 500 feet thereof, the bill states.

The bill, House 3190, had a hearing last week, where it received support other lawmakers, several of the state's water committees, and some private organizations. The DPW opposed the bill at the hearing.

"The proposed bill will take time to construct, will be somewhat costly, and will involve destruction to the roadway," said Scott L. Pickard, a spokesman at DPW.

Instead, the DPW suggests that Cambridge look at alternative proposals before taking the dramatic step of redirecting the drainage pipes.

One such alternative, said Pickard, is the use of a salt-substitute for highways. The DPW is currently testing for the first time this winter, a "pre-mix" of four parts sodium-chloride and one part calcium-chloride.

Attached are examples of public relations materials used during the reduced salt policy campaign. Included are newspaper articles and letters pertaining to the policy.

Letters

Less salt, more car accidents

At last our environmentalists have the chance to learn the difference between having principles and acting on them. Until now, environmental actions like eliminating salt from the treatment of icy roads have been done in response to environmental rhetoric.

But 60 accidents on the Mid-Cape Highway resulting from the environmentalists' rhetoric, and the consequent personal injuries and property damage, will almost certainly force increases in the rhetoricians' auto insurance premiums for 1988, in the same amounts as those for everyone else.

It's not clear that the environment will have gained, but it's a sure bet that the injured from 60 accidents and all car owners will lose.

ED STEEVES
South Harwich

Drivers were rude after snowstorm

It was nice to see and hear about all the "good deeds" and assistance people gave to each other the day after the big snowstorm. Unfortunately, the next day (Wednesday) many drivers forgot their manners and good Samaritan ways.

So many Cape drivers turned into rude and foolish drivers. People were driving too fast on snow and ice-packed roads and ignoring stop signs. Drivers were using the disabled traffic lights to their owr advantage, as if the road belong d to them. Also, many drivers were tail gating cautious drivers, forcing them to go faster on chunky and dangerous roadways.

It made me so angry to see these drivers take their lives and the lives of other and put them in a potentially dangerous situation. When weather conditions are bad, drive accordingly and you may save yourself a fender bender or, better yet, save a life. You will also give the courteous drivers a welcome sigh of relief.

LAURIE M. CROCKER
Hyannis

CCTIMES 2/20/87

Wyoming roads on salt-free diet

I recently returned from Wyoming, where storms like our recent blizzards are normal. Interestingly, in light of the current debate on salt usage here on the Cape, Wyoming does not use any salt on its roads. The plows come through and clear the snow, leaving a hard packed, smooth layer on both state highways and ordinary streets. In those conditions, drivers do what Cape Codders seem to regard as an unnatural act. They slow down.

They also invest in real snow tires, not just all-weather radials. Both front and rear wheel drive cars use them, and they help. In return for the extra time it takes them to get around and the investment of a couple hundred dollars in proper tires, Wyoming residents avoid costly rust repairs. Their cars die when the engines do, not when the bodies rust away. In addition, the snow stays white, windshields and rear windows stay clean, and road-salt contamination is not a problem in their ground water.

Our recent problems are not due to the DPW's low-salt policy. They are due to Cape Codders venturing out with inadequate tires and driving recklessly. Snow is slippery stuff and deserves to be treated with respect. And protection of our ground water is worth a bit of invonvenience.

FRANK LOWENSTEIN
Osterville

CCTIMES 2/21/87

Reduced salt test termed a 'failure'

There seems to be little sense forcing carmakers to increase safety measures when the state doesn't take equal responsibility toward keeping the roads in passable conditions.

A week after two blizzards, despite massive help, the Cape roads were still rutted, icy and dangerous. Common sense would dictate that in such a vast emergency situation, extra salt and sand be used; but Governor Dukakis seems more interested in running for president than in running the state.

Politicians count on voters' memories melting away in spring thaws, as they return from junkets spent in warmer climes, wondering what the fuss was all about. We no longer live in a Currier and Ives environment. People must go to work, replenish food supples, be able to walk and get to the bank with some assurance of safety a few days after any storm.

With the lives of drivers in jeopardy, there is no point in continuing a test already proved to be a failure.

MARGARETTA B. SINGER
Centerville

RECEIVED
A. S,355 Boston, MA
27/74
JUN 5 1986

NEW ENGLAND NEWSCLIP

Low salt plan

MSEW

A major breakthrough in use of salt on the Cape's state owned roads may be right around the corner, according to Armando Carbonell, executive director of Cape Cod Planning and Economic Development Commission.

If the plan is formally approved, the mixture of salt and sand applied to roads for snow and ice removal will be reduced to four parts sand to one part salt in time for next winter. Current state regulations call for either pure salt or a one to one mixture, depending on conditions.

Carbonell said the sudden change in policy may be the first concrete result of last April's meeting between Governor Michael Dukakis and 15 Cape environmentalists.

Last winter the state began a pilot project in Eastham where road salt levels were drastically reduced. Though preliminary results showed no increase in traffic accidents, the study was slated to continue for at least another year before any Capewide policy changes were adopted

Road salt has been linked to increased nitrate levels in Cape Cod drinking water. Excessive nitrates can cause heart trouble, hypertension and, in rare cases, birth defects.

Chatham's calcium chloride is an alternative

Local officials support continuation of low salt application

18/51

by William F. Galvin

HYANNIS–Local officials and state Department of Public Works officials are planning to continue the use of low salt applications along state roadways on Cape Cod.

That was the message Tuesday morning when a Cape Cod Planning and Economic Development Commission subcommittee on road salt convened a public hearing here to discuss the issue.

Subcommittee chairman Selectman David Humphrey of Eastham said there have been requests to retreat from the one portion salt to four portion sand ratio now used to the former one to one mix.

There have been a number of organizations working for as many as 15 years to get the state DPW to go to the four to one ratio. The leader in that move has been the Association for the Preservation of Cape Cod as far back as 1972. But it was the pressure from the Barnstable County Selectmen's Association together with the Cape legislative delegation that proved instrumental in the change two years ago.

Last year a pilot program was conducted quite successfully in Eastham, though it was a winter of light snow. This year was the first year the program was put in place. The one to one mix was, however, continued on the Mid Cape Highway and a section of Route 28 from Falmouth to the Bourne Bridge.

The four to one ratio was adopted two years ago when the Cape legislative delegation pleaded with the state commission of the DPW to reduce the use of salt to protect the Cape's sole source aquifer, according to Robert Smith, district highway engineer for the state DPW.

"We knew the driving conditions weren't going to be the same. We knew you would get a pack on the road," stated Smith. "It was a choice, bare roads or protection of the aquifer."

Admitting there has been a cry to revert to the old policy, Smith said, "To change the policy because of one storm is wrong. Implementing emergency changes are also wrong," stated the district highway engineer.

He explained that salt preparations are made before a storm and predictions are not always correct. He asserted that a one to one ratio might be applied and the storm might fall short of expectations and people would be up in arms with the amount of salt used.

Jon Beekman, a consulting engineer for Whitman and Howard and a member of a special legislative committee on water supply concurred with Smith. He also said the salt de-icing problem needs comprehensive study. He said there are a number of public health and safety issues and more public forums will be needed to mesh these concerns together for public benefit. He also urged additional public education for reducing speed in such conditions.

Richard Brown, representing the APCC at the hearing, said his association has released a report that pinpoints salt problems in wells located within 200 feet of roads.

Beekman said more attention is going to have to be given to additives other than salt to assist in de-icing along highway. He said in the northern part of the state a calcium chloride solution is now being tried. The town of Chatham will also be implementing that program possibly by the end of this snow season.

Beekman admitted he is not an expert on the calcium chloride issue, but he said it is also being experimented with around the reservoir section of Route 128.

"It can get slick, it acts that way in the colder weather," stated Beekman. But he said the results have been good. His question was, is there a mix that works better. He said the state DPW is exploring that now with federal highway funds. He also said some states are experimenting with using the chemical in the last phase of pavement mix.

HYANNIS, MA
D. 41,821

NOV 19 1986

NEW ENGLAND NEWSCLIP AGENCY, INC

State unveils plan to cut salt use on Cape roads

MDPW

By DANIEL RING
STAFF WRITER

BOURNE — A low-salt diet for local state highways this winter should improve the area's drinking water, but may be hazardous to the health of Cape Cod motorists.

The state Department of Public Works will reduce by half the amount of salt used to control snow and ice on state highways on the Cape this winter, Robert Tierney, commissioner of the state Department of Public Works, said yesterday.

The new policy will cut the amount of sodium chloride that gets into the ground water and town and private wells, Tierney said. It also means the roads will be a bit more slippery and dangerous during winter storms, Tierney said.

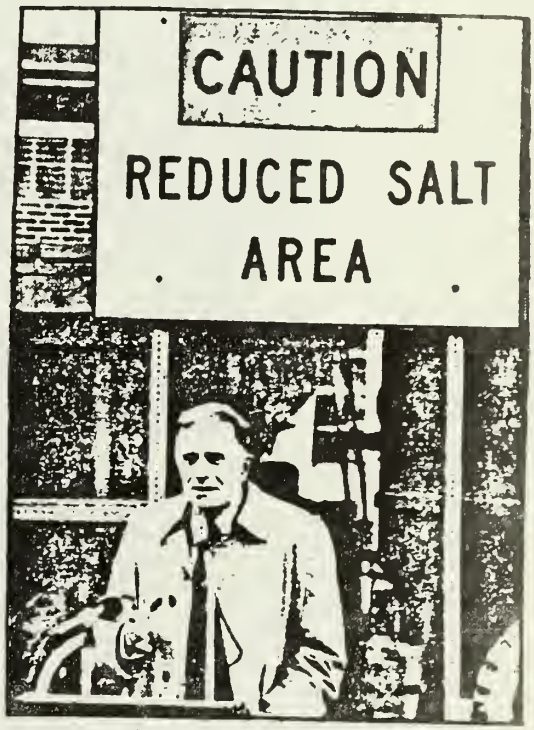
The policy was announced at a press conference yesterday, but state officials have been talking about the policy publicly for several weeks, and have said they will continue to publicize the issue so that drivers are aware of the potential driving hazards.

"The motorist will see conditions which are more like local town roads than they are state highways," Tierney said, speaking at a press conference outside the state police barracks in Bourne yesterday morning. "This is a very important consideration for motorists who are using the Cape.

"We'll be asking that drivers step back in time some 25 years into driving conditions which were typical shortly after World War II and in the 1950s," Tierney added. "We want to let people know that something different is occuring when you get on Cape Cod."

The state will not reduce the amount of road salt on the Mid-Cape Highway between Bourne and Orleans or on Route 28 between Bourne and Falmouth, Tierney said. It will continue to use one ton of salt for every ton of sand to maintain driving conditions on those two roads, he said.

On other Cape state highways this winter, it will spread a mixture of four tons of sand for every ton of salt, he said. The state is testing the new policy on the Cape this winter and will expand the program to other areas if it's successful, Tierney said.



STAFF PHOTO BY SHERWOOD LANDERS

State DPW Commissioner Robert Tierney explains the state's new policy on the winter use of road salt.

Signs have already been posted on many state highways to warn drivers of the new state policy, he said. The state is also planning to discuss details of the program during public forums in December in Falmouth, Yarmouth, Eastham and Bourne, he said.

Esther Snyder, executive director of the Association for the Preservation of Cape Cod, applauded the new program during the press conference. She said it will help protect the Cape's vast underground aquifer, its only source of drinking water.

"We consider this a very important decision," Ms. Snyder said. "This is a wonderful day as far as we're concerned for ground-water protection on Cape Cod."

DENNIS BULLETIN
DENNIS, MA
W. 9,000

NOV 25 1986

NEW ENGLAND NEWSCLIP AGENCY INC.

MDPW

State cutting down on salting Cape roads

By Charlene Vincent

The people of Cape Cod wanted it and they got it.

Beginning this year the roads will no longer be salted when slippery; instead, they will be sanded. The decision to change the policy came in the wake of strong public outcry by Cape Cod communities, according to Deparment of Public Works district liaison Wayne Duchemin.

"It was in the best interest of the Cape to make the change as soon as possible," Duchemin said in a telephone interview last week. Public concern over salt getting into the drinking water supply led Commissioner Robert Tierney to implement the change this year.

Last winter, the Town of Eastham was used as an experiment for the change from 50 percent salt and 50 percent sand to the new four tons of sand to one ton of salt.

"The test site in Eastham last year did not provide real good data," because of the mild weather conditions last winter, said Duchemin. In spite of this, Duchemin said the commissioner thought it best to make the change now because of public sentiment.

Duchemin said and "case by case we'll try to stick with it."

"This is not an experiment, this is a change in policy,"

The changes will affect most towns on Cape Cod. Signs have been posted on roadways reminding drivers of the reduced salt conditions. Those areas undergoing the change include: Route 6A from the Bourne Bridge to Orleans, Route 28 from Falmouth to Orleans, and Route 6 from the Eastham rotary to Provincetown.

The only areas exempt from the change will be the Mid-Cape Highway from the Sagamore Bridge to the Orleans rotary and Route 28 from the Bourne Bridge to Falmouth Hospital.

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NEW ENGLAND NEWSCLIP AGENCY INC

State Warns Drivers: Less Salt On Roads

Motorists using state-maintained highways on the Outer Cape have been cautioned that a reduced mixture of road salt will be used this winter.

Wayne Duchemin, spokesman for the state's Department of Public Works, says the usual "one-to-one mix of a ton of sand to a ton of salt will continue to be used on the Mid-Cape highway from the Sagamore Bridge to the Orleans-Eastham rotary but from there north to Provincetown on Route 6 a mixture of four tons of sand to one of salt will be used. This mix was used in a test section of the highway in Eastham last winter."

The four to one mix will also be used on Route 28.

Mr Duchemin said the state will spread 300 pounds of the mix per mile on state-maintained roads.

YARMOUTH SUN
SOUTH YARMOUTH, MA
W. 11,600

NOV 26 1986

NEW ENGLAND NEWSCLIP AGENCY IN

State cutting down on salting Cape roads

MDPW

By Charlene Vincent

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REGISTER
YARMOUTH, MA
W 9,359

NOV 27 1986

NEW ENGLAND NEWSCLIP AGENCY INC

Dana Hornig

Sensibility Gap

DPW

Slowing down, for ice and snow

The state Department of Public Works does not exactly move with the finesse of a free safety. A heavily taped nose guard, maybe. And so it almost got blind-sided last week. It snowed before December.

The frozen groundwater recharge event didn't amount to anything on Cape Cod. That's because it never snows on Cape Cod. That's what the Chamber of Commerce tells us anyway. Winter golf, and all that. In truth, we do get some white stuff. But considerably less, usually, than points inland. And true to form last week the snow flew around but nothing stuck to the ground.

Or to the roads, more to the point. Still, the flakes sent the DPW racing to the press release machine to, ah, incidentally, remind Cape motorists that this winter it is, on most of its roads here, trying a reduced road salt mixture "experiment."

DPW trucks will be cutting back on the amount of sodium dumped. It's a major response to environmentalists' long-standing concerns about road salt leaching into ground and surface water bodies. DPW, long stubborn on the matter, deserves much praise for finally giving in and, in whatever limited way, realizing that local communities -- not DPW bureaucracy -- must ultimately judge for themselves the relative risks of groundwater pollution and reduced traction.

Nowhere in the state is the issue more important than Cape Cod, with its sole source aquifer. State roads on the mid-Cape involved include Rtes. 28, 6A, 132, a piece of 134, and, to a lesser degree, Rt. 6. Until now, DPW policy was to spread 100 percent pure salt (at the rate of 300 pounds per lane mile) at the beginning of snow storms, then shift to one-to-one sand-salt mixture thereafter. This winter the "experiment" will eliminate direct salt application and spread four parts sand to one part salt on all roads except the Mid-Cape Highway. That reduces it to 60 pounds salt per lane mile. Route 6 will no longer get 100 percent salt doses, but will get one-to-one spreads, or 150 pounds per lane mile.

The DPW agreed to do this many months ago. But public forums planned to get people thinking about it haven't yet been held. Thus DPW staff did a little accelerated publicity feet shuffling last week because, quite frankly, they're afraid people have forgotten how to drive on ice and snow.

Indeed, it's interesting they're calling it a reduced salt "experiment." It isn't really research to discover something new and better about foul weather road maintenance. DPW's "snow and ice engineer" isn't going to learn anything new about engineering.

The experiment is sociological, to see if people can turn the clock back and slow down. It's a human behavioral experiment. It will reveal how spoiled we've become. Or it will indicate how oblivious we've grown to the physics of driving our cars -- how disconnected we've become inside our cars to the real road holding conditions outside.

Or perhaps it will show how unwilling we've become to adjust the pace of our lives to very real, natural climatological pace setters.

I'm not too worried. Towns already apply salt in conservative doses, sometimes less than the one of salt, four of sand ratio. Despite DPW's past attempt to render its roadways totally snow and ice free, I sense people speed down state roads only because they can. I don't hear people praising this convenience. I do hear people bellyaching about their salt-soaked cars and the need to thoroughly wash them after the smallest storm in order to prevent rust.

We're ready to slow down. Particularly on a peninsula where it never snows (or, at least where the snow on roads only lasts a few days).

Most particularly because it's the prudent thing to do to protect the community's sole source of drinking water.

BARNSTABLE PATRIOT
HYANNIS, MA
W. 2,436

D-7

DEC 4 1986

NEW ENGLAND NEWSCLIP AGENCY, INC

Others Say

MDPW

Less Salt on the Roads

None too soon the state is reducing the amount of salt that it spreads on its highways to melt snow and ice. The mixture will now be four parts of sand to one of salt. The state DPW trucks have been spreading a mixture made up equally of salt and sand. It melted snow and ice quite effectively, but very large quantities are involved, thousands of tons on Cape Cod highways, and the four-to-one mixture will mean a lot less salt filtering down into the water table.

It is the human animal's impatient and imperative nature to strive to tame the elements and reduce their effects so that business can proceed briskly and on schedule no matter what the weather. Slippery, icy roads are not something to be tolerated so long as there is any means of getting around them. Heavy use of salt has been that means. The price of uninterrupted traffic in icy conditions has been an imperiled water supply.

"People must understand that you can't do sixty miles an hour twenty minutes after a snowstorm," said an official in the Mashpee meeting where the state's new policy was discussed.

That is the key message. From now on, accept the fact that roads will be dangerous when there is snow or ice. Slow down. The inconvenience will be in a good cause: preservation of Cape Cod's vital water supply.

The Enterprise
Falmouth

DEC 9 1986 42

NEW ENGLAND NEWSCLIP AGENCY INC

News Item: The state DPW plans to cut down on the use of road salt.

CAPE COD TIMES
HYANNIS, MA
D. 41,821

DEC 11 1986

NEWSCLIP AGENCY

Salt substitute: Added care needed by Cape drivers during winter

MDPW

By JAMES KINSELLA
STAFF WRITER

HYANNIS — Cape motorists can expect messy, slippery state highways during this winter's storms, a state Department of Public Works spokesman warns.

Because the state is decreasing the amount of salt used on five state highways on Cape, "People are going to have to expect some kind of mess out there," said Wayne Duchemin, liaison coordinator for District 7, the regional highway district that covers the Cape and Islands.

"It's going to be a pack (of snow), or some kind of slush," Duchemin said yesterday. "It's not going to be bare pavement."

In an interview at the Cape Cod Times, Duchemin said the state's new low-salt policy will worsen driving conditions. The state is cutting back on salt applications to protect Cape Cod's sole-source aquifer, he said.

The state will continue to use its previous mix — one ton of salt to one ton of sand — on two stretches of major Cape highways: Route 28 from the Bourne Bridge to Falmouth Hospital, and the Mid-Cape Highway from the Sagamore Bridge to the Orleans-Eastham rotary.

But the ratio will be reduced to four tons of sand to one ton of salt on the Cape's other state highways. Route 6 from the Orleans-Eastham rotary to Provincetown, Route 28 from Falmouth Hospital to Orleans, all of Route 6A and Route 28A, and the section of Route 132 from Phinney's Lane, Hyannis, to Route 6A.

"What it means to driving conditions is turning the clock back 30 years," Duchemin said of the policy, which will be in effect on the Cape all winter.

"You'll be driving on a packed road surface," he said. "What the salt did was to break up the pack."

Through the application of salt, applications that sometimes were repeated, the department was able to get the snow-covered roads down to bare pavement in 24 hours, Duchemin said.

But department officials now plan to lay down just one application during a storm and stop there. Local highway foremen had the discretion to lay down more salt in "real problem areas" during storms, he said.

Duchemin said the department intends to use the local and state police as the department's "eyes" during storms. Rapid reports from the police to the department can get plowing crews out on the highway within an hour of the first snowfall, he said.

A reduced mix of salt to sand was used on Route 6 in Eastham last winter, Duchemin said. But last winter was so mild that state officials could not tell if the decrease in salt led to more accidents, he said.

No information was available yesterday from the department on the amount of salt and sand laid down on state highways on the Cape last winter or in the average winter.

To assist Cape drivers, Duchemin said, he will issue storm reports to local radio stations that will address conditions on specific roads. The reports will be read at about 6 and 8 a.m. and again at 3:30 and 5 p.m., he said.

For Cape Codders not used to driving on snow-covered roads, Duchemin offered the following tips.

- Drive no faster than 30 mph. Pull over to let through vehicles that are going faster.
- Pump the brakes — don't ride them — to stop the vehicle.
- If the vehicle starts to skid, turn it in the direction that the tail of the vehicle is going. If the tail is going to the right, turn to the right.
- Do errands before storms arrive.
- If going out in a storm is necessary, make sure that someone knows you're going out and your destination.
- Carry cold weather equipment in the car such as a container of sand and a shovel, a windshield scraper, tow chain or rope, flashlight, blankets or sleeping bags, heavy gloves or mittens and extra woolen socks, overshoes and headgear.

CAPE COD TIMES
HYANNIS, MA
D. 41,821

1/41

DEC 13 1986

NEW ENGLAND NEWSCLIP AGENCY, INC

mDPW

In Our View

Our low-salt diet

The state Department of Public Works has put some of our roads on a sodium-restricted diet this winter, which may make winter driving less pleasant at times but also will help preserve our water supply and maybe save our lives.

Like many of the Cape's town highway departments, the DPW has begun to show more respect for our fragile sole-source aquifer — our only supply of drinking water.

Salt, our environmental scientists have learned, does a great job melting ice and snow on our highways, but it also sticks around long after it has done its melting job. As the snow melts, it carries the salt with it into the aquifer. Eventually, we drink it. And almost any physician will be pleased to lecture us at great length about the health threats posed by salty water.

So the DPW has followed the lead of many Cape towns and drastically cut the amount of salt it mixes with sand for spreading on icy state highways here. Until this year, the mix was a ton of salt to a ton of sand. This year, it'll be a ton of salt to four tons of sand. That's the mix that will be used on Routes 6A, 28, 28A, 132 from Phinney's Lane to 6A, and Route 6 from the Orleans rotary to Provincetown. Only Route 6 from the Sagamore bridge to the Orleans rotary, and Route 28 from the Bourne bridge to Falmouth Hospital will get the 1-to-1 mix, since they are heavily traveled, high-speed, limited-access roadways and particularly dangerous when snow-covered.

While this sort of environmental consciousness should win applause from all of us, driving conditions *will* be poorer this winter. "People are going to have to expect some kind of mess out there," DPW spokesman Wayne Duchemin said this week. "Things aren't going to be the same." Thursday night's wet snow gave us our first taste of that.

But the DPW also is working hard to offset some of the problems that reduced salt will cause. They plan to get their sanding trucks on the roads earlier, Duchemin said, and they'll put down as many applications on the low-salt roads as they do on Route 6. The state also plans to invest greater effort in public information — getting the word out in radio road reports early and often.

The driving public, however, will have to do its share in this effort to slow the contamination of our water supply. Driving safely is the biggest part of it. Keep your speed at or under 30 in bad driving conditions. Stay at least three car lengths behind the next vehicle — and pull over if someone's tailgating you. Keep your car in good mechanical condition — breakdowns are unpleasant for you and for the people trying to plow the roads. Keep your lights on. Use snow tires. Keep flashlights and warm blankets in the car. If you do go out, leave early and be sure someone knows you're out there and where you're going. Best of all, stay off the roads, if at all possible.

State and local efforts to cut salt usage may be inconvenient, but they're worth the effort. So please be patient, and be careful.

A postscript: One of the reasons our highways are so inconsistently plowed in winter storms is that the DPW doesn't have enough money to do the job itself. The DPW owns few plows, and most of the snow removal on state roads here is done by private contractors — who, DPW official Duchemin says, are often reluctant to put their plow blades all the way down and drive at anything faster than a crawl. This makes their plow blades last longer but results in inefficient snow removal. We'd like to see the state do the plowing on its own roads — an approach that works well in a lot of other states.

The Legislature has been more generous in its DPW funding recently, so perhaps more plows and salaries for the operators could be part of the next DPW budget.

JAN 21 1987

NEW ENGLAND NEWSCLIP AGENCY, INC

Officials differ on effect of reduced road-salt use

MDPW

By JAMES KINSELLA
STAFF WRITER

Reports are inconclusive on the effect of the state's new policy of reducing the amount of salt applied to several major Cape highways.

The storm that blanketed Cape Cod roads with ice and snow Monday night and yesterday morning provided the first test of the new state policy, which the state Department of Public Works announced in November.

Wayne R. Duchemin, a spokesman for the department district that covers Cape Cod, said the new policy "obviously" has had an effect.

"We do have packed and icy sections throughout the Cape, especially on the 4-to-1 sections," said Duchemin, referring to the highways where the state uses a proportion of four parts sand to one part salt.

Also, Duchemin said, the falling temperature that came after the initial snowfall cut the effectiveness of the salt that was laid down to melt the ice.

"Right now, if we tried scraping it off, we'd lose the pavement," he said.

But state and local police contacted about the effect of the new policy said they did not notice an increase in accidents, or any differences between the sections with heavier and lighter salt applications.

Under the new policy, the state is continuing to use its previous mix — 1 ton of salt to 1 ton of sand — on two stretches of major Cape highways: Route 28 from the Bourne Bridge to Falmouth Hospital, and the Mid-Cape Highway from the Sagamore

See REDUCED, Page 9

CAPE COD TIMES
HYANNIS, MA
D 41,821

JAN 28 1987

NEW ENGLAND NEWSCLIP AGENCY INC

Cape roads try out low-salt winter diet

MDPW

By DONALD BRICHTA
OTTAWAY NEWS SERVICE

BOSTON — The price for clean roads this winter may be a glass of dirty water.

Public works crews have been using a lot of salt to ensure safe travel But that salt use has a negative side — contaminated drinking water — whose potential for harm is only now getting much attention.

The state Department of Public Works is trying some novel methods to keep highways clear while also protecting water supplies.

The department's goal of bare, wet pavement following snow and ice storms is taking a bit of a back seat this year, particularly on Cape Cod, which relies on an underground aquifer for all of its drinking water.

In past years, state highway crews used equal parts of salt and sand to treat Cape roads. This year the mix in some experimental areas is four parts sand to one part salt, said Scott Pickard, a public works spokesman.

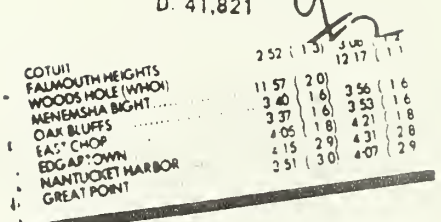
Similar policies are in effect in select areas across the state, particularly near reservoirs and underground water sources, called aquifers. One such area is a 2-mile stretch of North Beach Road in Salisbury.

In Bristol County, the state is experimenting with a non-salt chemical treatment on 5 miles of Route 138 in Somerset, adjacent to the Taunton River.

That chemical, called calcium magnesium acetate, is expensive, costing $560 per ton, compared with $30 per ton for road salt, Pickard said Test wells are being used to tell how effective it is, he said

Replacing the 200,000 tons of salt that the state uses annually would cost much more, but environmentalists say selective use of such methods in sensitive areas is a small price to pay to ensure clean water.

CAPE COD TIMES
HYANNIS, MA
D. 41,821



The number ... All ... road salt

From Page 1

Bridge to the Orleans-Eastham rotary.

But the state has reduced its ratio to 4 tons of sand to 1 ton of salt on the other major highways that it covers: Route 6 from the Orleans-Eastham rotary to Provincetown, Route 28 from Falmouth Hospital to Orleans, all of Route 6A and Route 28A, and the section of Route 132 from Phinneys Lane in Hyannis to Route 6A.

State officials decided to reduce the amount of salt because of the possibility that it will filter into the Cape's sole-source aquifer, which also is its sole supply of drinking water.

Sgt. Ronald Pelletier of the state police's Bourne barracks said that although the roads were slippery in the barracks' coverage area, no accidents occurred Monday and only a couple of minor accidents yesterday. Pelletier said he did not know whether they were related to the new salting policy.

He also questioned what effect salting could have in certain storm circumstances.

"The way the snow was coming down last night . . . I was on Route 195. It could not be any worse than that and I'm sure they were salting there (on that highway)," he said.

Trooper Joseph MacDonald of the state police's Yarmouth barracks reported "no problems" with any of the state roads covered by the barracks. The storm only brought "a couple of minor accidents," MacDonald said.

In Falmouth, according to Falmouth police Capt. Paul Poulos, "The roads were a mess this morning — icy, a lot of bad areas."

But Poulos couldn't say whether the state's new policy had affected the roads, and said no one in the department had mentioned to him any difference between the more- and less-heavily salted sections of Route 28.

As for accidents, Poulos reported one minor accident yesterday morning and none the previous night.

"So that's not bad," he said. "Traffic was light last night. (With) this type of storm, people stay home."

Orleans police Lt. Lucien Ozon reported only one car off the road, on Route 28 in South Orleans yesterday morning.

Although it might be possible to determine if more salt makes a difference in some storms, the recent storm wasn't one of them, Ozon said. The police received no complaints about the new salting policy, he said.

In Truro, Patrolman Tamson Garran said that it took longer for the highways to clear than usual after a storm, but cautioned against comparing the "apples and oranges" of different storms.

VINEYARD GAZETTE
EDGARTOWN, MA
2XW 12,800

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FEB 6 1987

NEW ENGLAND NEWSCLIP AGENCY INC

mDPW

A MAMMOTH EFFORT

Editors, Vineyard Gazette:

The West Tisbury board of selectmen sent Ronald Jeffers of the state Department of Public Works the following letter.

•

The board of selectmen wishes to make known to all, the excellent job of the Department of Public Works in clearing the state highway as it runs through town. This was, as we understand, the largest accumulation of snow in a single storm in 34 years.

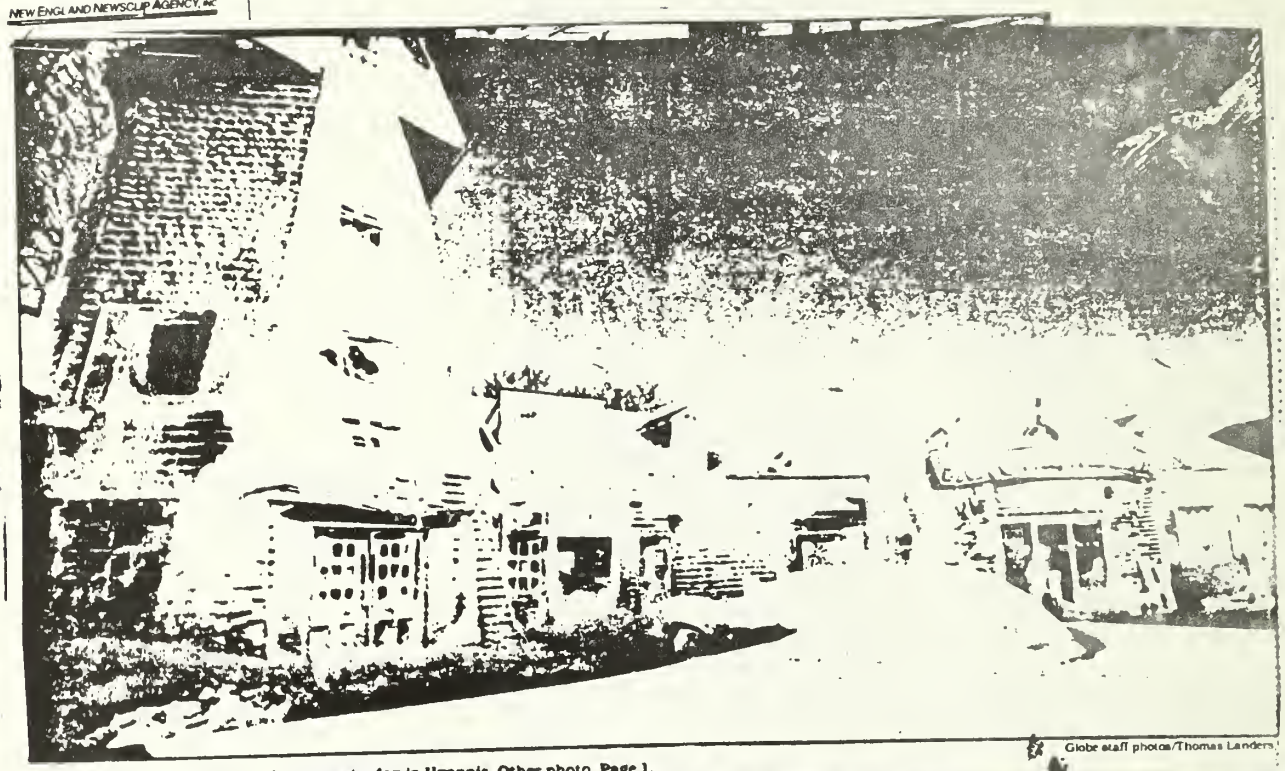
The morning after the storm the highway was not only passable and sanded, but the bare pavement was clearly not evident in many areas. By mid-afternoon the pavement was cleared of snow and slush in over 80 per cent of the town.

We realize this was a mammoth undertaking on your part and we are very appreciative of the job that you have done in making the roads safe again for winter travel.

John S. Alley

West Tisbury

BOSTON GLOBE
BOSTON, MA
D. 502,928
FEB 11 1987
NEW ENGLAND NEWSCLIP AGENCY, INC



Globe staff photos/Thomas Landers

Snow covers a line of shops and a car yesterday in Hyannis. Other photo, Page 1.

Cape gets state aid in blizzard cleanup

By Teresa M. Hanafin
Globe Staff

FALMOUTH – It has been a brutal one-two punch that Cape Codders won't soon forget, the kind of winter that will live on in Cape lore much as the Blizzard of '78 does in the annals of other New England regions.

Aided by National Guard troops and snow removal equipment from around the state, Cape Cod yesterday began the long, tedious process of digging out from under the worst blizzard to hit this area in decades.

Anywhere from 15 inches to 2 feet of snow fell from Sandwich to Provincetown Monday, piling on top of 18 inches that fell during a blizzard that swept across the peninsula just two weeks ago.

Winds that gusted as high as 80 m.p.h. created massive snowdrifts and knocked down power lines in each of the Cape's 15 towns and on Martha's Vineyard and Nantucket, leaving more than 50,000 homes and businesses without electricity and many of those without heat or hot water as well.

Yesterday morning, Gov. Dukakis declared a state of emergency in Barnstable, Dukes and Nantucket counties and ordered Massachusetts National Guard troops to the Cape to help with the cleanup.

CAPE COD, Page 19

Power lines hang low along the unplowed Lincoln Road Extension in Hyannis yesterday morning.

residents to shelters.

Middle School.

In announcing the mobiliza-

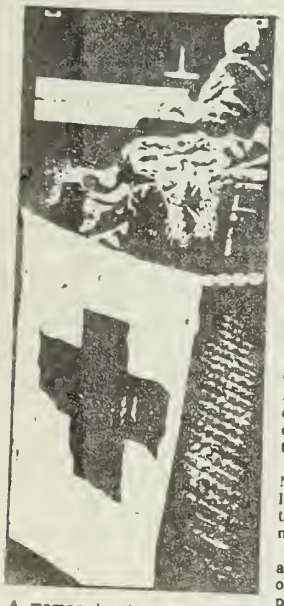
At the Hyannis shelter in

funny now, huh?"

Two men help a motorist back his car out of the snow along Main Street in Hyannis..

Globe staff photo Thomas Landers

Cape gets state help in cleanup after blizzard



A woman is given a place to sleep yesterday at a shelter set up by the Cape Cod Chapter of the Red Cross in Barnstable Middle School.

Emergency declared in 3 counties; National Guard summoned

■ CAPE COD

Continued from page 17

Hundreds of residents spent Monday night, yesterday and last night in shelters set up in each town.

There were no major accidents or injuries reported to Cape police departments, although a spokeswoman for Cape Cod Hospital in Hyannis said emergency room personnel were extremely busy treating people for finger lacerations from operating snowblowers and chest pains from too much shoveling.

Public Safety Secretary Charles V. Barry and Maj. Gen. Anthony Spadorcia, adjutant general of the National Guard, arrived on the Cape yesterday afternoon to help coordinate cleanup efforts.

Spadorcia said that about 200 National Guard troops were mobilized from engineer units stationed on Cape Cod and in Whitman, Reading and Newburyport.

More than 50 pieces of National Guard equipment and 35 pieces of equipment from the state Department of Public Works also were sent, including five- and 2½-ton front-end loaders, graders, bulldozers and four-wheel drive trucks.

In announcing the mobilization, Dukakis said the prime reason for sending the equipment and manpower was to assist towns in clearing side streets so utility companies could reach downed power lines.

While most towns experienced scattered outages, every resident of four towns lost power: Provincetown, Wellfleet, Harwich and Dennis, according to Robert G. Caron, spokesman for Commonwealth Electric Co. Most of Truro's residents also lost power, he said.

Nantucket, which is served by Nantucket Electric Co., also lost power during the storm.

As of 6 p.m., about 20,000 customers still were without power, but company officials were in the process of restoring electrical service to 12,000 customers on the lower Cape. Caron estimated that 6,000 to 7,000 customers still would be without power this morning.

Workers used two helicopters to survey the company's main transmission lines and snowmobiles to reach many downed lines, Caron said.

Police departments across the Cape transported medical personnel to Cape Cod and Falmouth hospitals and took hundreds of residents to shelters.

At the Hyannis shelter in Barnstable Middle School on Route 28, Red Cross volunteer Michael Grossman said 85 persons had used the shelter since it opened at 7:30 Monday night. As of 4 p.m. yesterday, about 40 adults and children remained.

Among those were Cheryl Strew, 28, and her four children, who lost heat and electricity at the Samurai Motel on Route 132 in Hyannis. Strew and her family are being put up at the motel by the state Welfare Department because they are homeless.

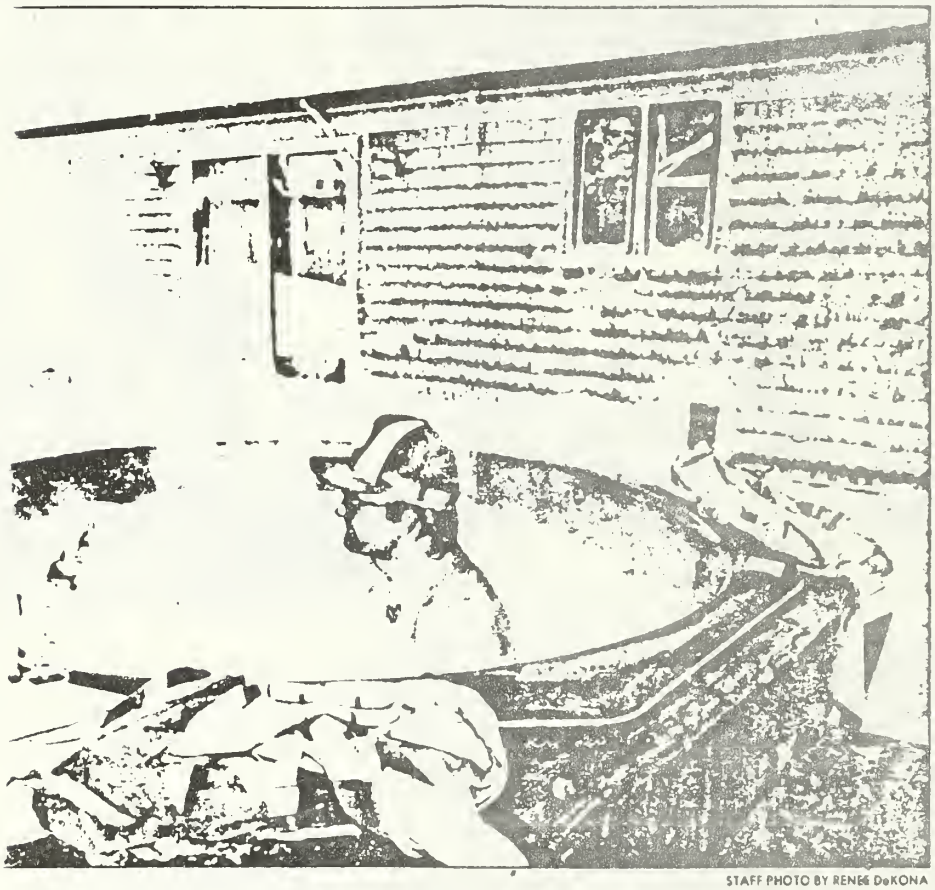
"It was cold in that room last night," she said. "My kids woke up screaming. I didn't know about this shelter or else I would have come here sooner. It's really quite cozy here."

Strew, raised in Worcester, has lived on the Cape for nine years and never has seen so much snow.

Neither has Gertrude Frost, and she has lived here all of her 82 years.

"You've got to go back a good 20 to 25, maybe even 30 years, to get a blizzard like this one," Frost said yesterday from her home in Eastham. "I don't think much of snow. Never did. That's one reason I'm still on Cape Cod. Kind of funny now, huh?"

ves Cape in emergency condition



STAFF PHOTO BY RENEE DeKONA

n a 104-degree hot tub in their back yard after shoveling out their driveway.

Power out; schools close; shelters open

By RICHARD HOLMES
STAFF WRITER

HYANNIS — Here's bad news for the several thousand Cape residents still without electricity because of the many smaller, isolated outages during Monday's blizzard:

You're last on Commonwealth Electric Co.'s list of repairs to be made, according to district manager Richard White.

As of last night, an estimated 10,000 homes were still without power. ComElectric crews working through the night and he o to have power restored to all custome by tonight, Robert Caron, supervisor of consumer relations, said late last night.

White yesterday afternoon said crews are repairing major power lines first, then the smaller distribution lines, and finally the lines that connect to individual homes. In addition, emergency situations are also being considered in determining the priority of each case.

Monday's blizzard socked Cape Cod with 15 to 23 inches of snow, with the Lower Cape receiving accumulations on the higher end of that range, according to reports from the National Weather Service in Boston.

The storm brought a limited state of emergency declaration by Gov. Michael S. Dukakis, designed specifically for Cape towns and resulting in an extra 200 National Guardsmen and Department of Public Works drivers, 60 department snowplows, and 10 National Guard front-end loaders being added to local road-clearing crews.

Hundreds of people from Falmouth to Provincetown were moved from their cold and dark homes to shelters in schools and stations and town halls while the electricity was out Monday night and yesterday.

All schools except Cape Cod Community College and those on Martha's Vineyard and Nantucket were scheduled to be closed again today, for the third day in a row.

At the storm's height Monday night, about 50,000 of ComElectric's 140,000 Cape and Vineyard customers had suffered from blackouts, White said.

By 10 last night, two of the worst outages had been repaired, according to Caron.

"We were able to bring back two major circuits, one in the Wellfleet and Provincetown area and the other in the Harwich and Dennis area," Caron said.

But there still were scattered problems all over the Cape, he said, adding that the utility hoped to have all but 6,000 to 7,000 customers back on line by this morning.

White said repair crews stopped working from 6 p.m. till midnight Monday because blowing snow made driving impossible. Yesterday, the district's repair crews were being

See STORM, Page 9

Guard, state Cape dig out

ational Guard and state public works crews the Cape and Islands.

The state trucks were told to clear main oads first, then move onto the secondary oads to allow utility companies to repair owned lines and restore power, said Jonahan Robbins, spokesman for the state Executive Office of Public Safety.

Many towns reported that they were unable to plow Monday night because of poor isibility and downed power lines. In addion, local officials said, because this bliz-

See EMERGENCY, Page 9

rgency cases f's endurance

the job for the 24th straight hour — weathered the storm.

"It's unbelievable. It just hasn't stopped," Ms. Robinson said, talking sporadically as she continued to work, monitoring the incoming ambulances. "It's so busy ... I can't really tell you how busy it is."

Over the course of an hour, 10 ambulances arrived at the emergency room door, bringing in stranded patients who needed to be

See HOSPITAL, Page 9

Pleading for plows and power

By LISA MARTIN
STAFF WRITER

FALMOUTH — When patience grows as thin and sharp as icicles, and residents wonder if they are going to be snowbound *forever*, they often reach for their telephones for solace.

Yesterday, the Falmouth police and department of public works were besieged by calls from aggravated residents smitten with cabin fever.

Callers ask, "Where's the power? Where's the plows?," said Patrolman Mark Deutschmann, who said he answers, "The power's out and the plows are out."

"Police have no authority over the plows, and we have no realistic estimate when power will be restored," said Sgt. Ronald DeMello. But the public has faith that the police can do something for them, he said: "Either that, or they are using us as a frustration valve."

Police officers gathered at the station's communications center yesterday, trying to answer complaints in the midst of regular duties, like feeding the prisoners lunch.

"It's nerve-wracking. When people call, there's nothing we can do except sympathize," said civilian dispatcher Ruth Parsons.

The police spent much of their time transporting nurses and doctors for duty at Falmouth Hospital. Residents without heat were taken to a shelter at town hall.

"We get requests for everything," DeMello said. "One man wanted us to take him to Falmouth Ford to pick up his vehicle."

On the plus side, crime is down.

At the public works office in town hall, "The phones have been ringing constantly," said secretary Alma Potter. In less than two hours, the office had received 57 calls, all of them from people who wanted their roads plowed, she said.

"They want to make the plows get to their roads faster," said Ms. Potter. "They are afraid we've forgotten them. They just want to talk to someone, so we reassure them."

But phoning the public works department doesn't really get a road plowed any faster, she said. "The plowers know what's done and what's not and they're working as fast as they can."

DIGGING OUT: THE DAY AFTER

...Storm

From Page 1

supplemented with more than 30 crews from other electric companies, he said.

In addition, ComElectric yesterday was using a helicopter to find fallen major power lines. Repair crews were reaching these major breaks by riding up the drift-covered easements on two machines designed to travel on snow.

White said the damage caused by Monday's storm was extensive, but not unusual. He said that he would place the storm in his "top 10" of those during the 28 years he's lived on the Cape.

"Those of us who have lived here for a while, you learn to get used to it (power outages caused by storms)," he said.

The strongest wind reported during the storm was a 67 mph gust in Falmouth, although meteorological technician Frank Perry, of the weather service's Chatham station, estimated that winds there reached 80 mph at one point. The station's anemometer, which measures wind speed and force, froze during the blizzard.

White advised that Cape Codders prepare for winter storms by keeping a kerosene lantern and a supply of candles on hand. He said owners of homes with private wells should fill their bathtubs in advance of a storm.

White groaned when told that the National Weather Service Monday had forecast the possibility of another major storm this weekend.

Although Monday's high winds and heavy snow disabled many electric lines on the Cape and Islands, the storm did little damage to telephone lines.

Carolyn McKeon, Cape and Islands community relations manager for New England Telephone, said the blizzard knocked out about 300 lines to individual homes — about three times the number of line problems on an average day, she said.

There were no widespead telephone outages, she added.

Like ComElectric, New England Telephone is supplementing its regular repair crews with those borrowed from other utilities, she said. She said she was uncertain how long it would take for all the problems to be repaired.

"Our biggest problem is that extra-heavy usage is tying up the circuits, making it difficult for other calls to get through," Ms McKeon said. "Our concern is emergency calls."

She asked that Cape Codders refrain from making unnecessary calls for the day or two so that emergency calls not be blocked or delayed.

The storm also stopped mail service across the Cape yesterday. Provincetown Postmaster Tom Graham said the storm interrupted power to the Postal Service's Buzzards Bay office, which sorts and distributes mail to all Cape post offices.

Without power, this sorting could not be done. As a result, no mail was delivered yesterday to any of the Cape post offices. He and spokesmen for post offices in Orleans and Hyannis said they believed mail delivery would resume today to areas that had been plowed.

"We'll probably have twice as much (mail as usual) tomorrow," Graham said.

Times staff writer Jack Perry contributed to this report.

Blizzard closes Sandwich roads

Sandwich highway surveyor Patrick Ellis said six Sandwich roads were closed at different times between 11 p.m. Monday and 3 a.m. yesterday due to treea that blocked the roads.

Boardley Road, Harlow Road, Great Hill Road, Old Main Street and Old County Road were closed for periods of time during the storm. Ellis said more than 50 trees came down in the blizzard.

"We have guys who've been here for 21 years who said that that was the worst storm that they'd ever seen," Ellis said. "We didn't anticipate the kind of power that that storm had and the length of the storm."

Ellis said that by 9 a.m. yesterday the main roads in Sandwich were plowed, and his men started working in the subdivisions. By last night, Ellis reported that all 115 miles of town-owned roads were open, although many roads needed widening.

Ernest Virgilio, director of the Mashpee Department of Public Works, said the storm had been "extremely difficult to cope with" because of a lack of equipment.

DPW chief says second storm worse than first

By WIN SCHLEY
STAFF WRITER

FALMOUTH — The blizzard of Jan. 26, Ron Nielsen said two weeks ago, was "probably the worst" he'd seen in 21 years with the department of public works.

Nielsen, the highway division superintendent, yesterday ate those words.

"I'd say this storm was three times as bad," Nielsen said grimly, shaking his head.

He was one of about 50 town public works employees who had battled rain, ice, snow, gale force winds and falling trees, limbs and utility wires since Monday.

"At 4 p.m. today, some of these guys will have been behind the wheel for 32 hours. I hope to shut down by midnight because that will make 40 hours — that's enough for anyone without sleep," said Nielsen yesterday.

Weary town employees and hired plow operators were joined yesterday afternoon in the continuing cleanup operation by state public works employees. Six state 10-wheel trucks were sent here from Braintree in conjunction with the state of limited emergency declared by Gov. Michael S. Dukakis.

Nielsen said the large trucks would be used to open up and widen out snow-clogged areas all over town, including Chapoquoit Island, Surf Drive and Oyster Pond Road, Falmouth Heights Roads, Sandwich Road and Route 151.

The rapidly changing conditions and high winds made the job of clearing the town's roads yesterday and last night a veritable nightmare, said Nielsen.

"The sudden temperature drop caused a lot of freezing and icing conditions," said Nielsen. "It made it really difficult for the plows to clear the roads."

As in the Jan. 26 storm, added Nielsen, some of the smaller contracted plows made one pass each way on some roads and then simply could not do any more.

...Hospital

From Page 1

plowed out of their homes and carried over snow-covered roads.

"Hello," an exhausted Brewster emergency medical technician said to no one in particular, as he walked in. He delivered his patient and went back out to pick up someone else. His eyes were barely open. His work boots and pants were soaked.

"What day is it?" asked Capt. Mac Pawloski of the Centerville-Osterville Fire Department. "Is it still Tuesday? Or is it Wednesday now?"

Pawloski wearily brushed the gray hair off his forehead. He had been working for 34 straight hours. Another member of the Pawloski team turned to the nurses:

"We have reservations for this young gentleman here," he said with a smile, gesturing to an elderly man on a gurney breathing into an oxygen mask.

"Oh yeah," laughed a nurse. "Well, just have a drink in the lounge and wait 'til we get the room ready."

The patient smiled, cheered by the joke.

Because of the backup of ambulance calls, information about the whereabouts of some ambulances was coming in by telephone instead of the normal radio system.

"If you lose it, it's a very contagious," Ms. Robinson said.

Ms. Robinson and several other 3-to-11 nurses came in Monday evening, prepared to stick around. By 11 p.m., it was apparent they weren't going home. Not only couldn't they get out, but also the relief shift couldn't get in.

Then she had to stay through the 7 a.m. to 3 p.m. shift the next day, since many of the nurses couldn't get in on time. They trickled in during the morning, but so many patients started arriving at the emergency room doors that the night nurses couldn't leave.

Nurses don't have to work the emergency room if they don't want to. The only people who work that high-pressure place are those who choose it.

"I love my job," said Ms. Robinson. "You never know what's going to happen. You have to keep on your toes."

...Emergency

From Page 1

zard's snow was so wet and heavy, snow removal equipment in this area was unable to cope with it effectively.

Although Dukakis declared a limited state of emergency for the entire Cape, with the exception of state highways, the National Guard and state public works crews were only working in those towns that had declared their own states of emergency — Falmouth, Barnstable, Brewster, Harwich and Wellfleet.

"Once the town makes a declaration of emergency, the state can go in," state Secretary of Public Safety Charles V. Barry said during a tour of the Cape yesterday afternoon. "We can't just go in, unless the towns ask for help."

As John Lovering, acting director of the state Civil Defense office in Framingham said, "They're saying 'ouch' out loud."

The selectmen declare a state of emergency upon the recommendation of the local Civil Defense directors, based on whether the town has expended all local resources for dealing with the storm, said Michael Stines, Civil Defense director for Barnstable. The declaration also allows local officials to spend money on the storm that has not been appropriated, Lovering said.

Equipment from Otis Air National Guard Base and the other extra heavy equipment dispatched by the governor arrived in Falmouth and began work there, before moving onto Barnstable then farther down the Cape.

Barry said he could not say how long it would be before most secondary roads were passable. He said more than 200 Guardsmen and public works employees were called to the Cape, including 35 public works snow plows, 10 National Guard bucket snow removal trucks and five large plows.

Asked if any areas in particular needed extra help, Barry said, "The whole area needs a little extra attention."

"I never thought in my lifetime that I would see this much snow on Main Street (Hyannis)," Barry said during a press conference at the Old Barnstable Town Hall. "It's a picture post card scene from some place up in Vermont."

NEW ENGLAND NEWSCLIP AGENCY, INC.

Sound Off

THOMAS CAESAR & SON TROY THATCHER

WALDO W. GUY

DR. VINCENT CAPILIA

JOHN SOTIRKYS

PENNY LAVINE

CLAIRE KEITH & GRANDSON SHANE KEITH

Question of the week:

Do you think the state Department of Public Works should have relaxed the new policy to use less salt on Cape roads in the wake of last week's storm?

Where asked: Dennisport

Claire Keith of West Chatham, motel assistant offi manager, with grandson Shane Keith:

"I think maybe they should have (eased the policy) that special storm. Last week was horrible. It took me a hour to get to Hyannis and I was very afraid I might los control of the car."

□

Dr. Vincent Capilia of South Dennis, retired or. surgeon:

"I think they should use salt in just a couple of the bi snowstorms like last week, but otherwise not use because of pollution to the water supply and to the tre and plants. But I think they did a good job (clearing) roads last week."

□

Waldo W. Guy of West Dennis, retired real estat agency operator:

"They should either do one thing or the other with (th salt policy), they can't do both. And if they want to go al the way with (the policy), they should leave it the way i is. We won't have any fresh water if they use the salt."

□

John Sotirkys of Sandwich, driver for the Coca-Col Bottling Co.:

"I would think with a storm like we had last week that the main concern would be to clear the roads no matter what it takes. The roads were bad. Even Saturday, you'd be on a main road, then you'd be on ice. The state should give in a little (on the low-salt policy). We don't have many storms like that."

□

Penny Lavine of Framingham and Harwich:

"For those types of conditions (last week) the state definitely should have lifted that rule for the safety of the people. We wouldn't come down here from Framingham because of the roads — we heard there were a lot of traffic accidents."

□

Thomas Caesar of Dennisport, construction worker, with son Troy Thatcher:

"The roads definitely needed salt last week. The ruts . . . tore my whole muffler system off. I don't think about those things (water supply problems) when it's not safe to drive."

□

Frances Lambton of South Dennis, retired:

"I've been here 18 years and that was the worst storm ever. (The policy) should have been relaxed last week to avoid accidents, but otherwise it's a great idea. They say it hurts the water table."

□

Muriel Jones of South Dennis, retired:

"They should use salt for a storm like that, but not all the time — it eats up your car. We come from Canada where they have equipment for a storm like that. We didn't go out much last week but when we did, the roads were very bad, especially on the corners where you could slide right out into traffic."

Text by Special Writer Kathi Scrizzi Driscoll; staff photos by Sherwood Landers.

13 8
FEB 11 1987 44
NEWS AND NEWSCLIPPING AGENCY

Second Major Snowfall Tougher For Highway Crew

Radio 'May Day' Brought Help To Home On Fire

MDPW

You have to imagine yourself in the situation to get a real sense of what a fortunate man Norton J. Stokes is today, and he owes it all to his hobby.

Mr. Norton, who lives on Edgewater Drive, East Falmouth, woke yesterday morning shortly after 7 to find fire spreading into the walls around his fireplace. Both his telephone service and electricity were out. Where to turn?

For Mr. Norton, who has operated a ham radio for many years, the answer was easy.

He put out a "May Day" and was promptly answered by Jim Priestly of Neshobe Road, Mashpee, who was monitoring his ham radio at the time. Capt. Joseph P. Rose of the Falmouth Fire Department said that Mr Priestly's call was received at 7:15, and firefighters reached the scene seven minutes later. Within an hour the fire had been brought under control.

A fleet of plows, including six 10-wheelers sent down by the state Department of Public Works, were still cleaning up Falmouth roads today after the second blizzard to hit the Cape in two weeks.

The state plows were responding to selectmen's declaration yesterday of a snow emergency.

Governor Dukakis opened the way for state help for beleaguered Cape towns by declaring a limited state of emergency, limited to the extent that the Cape and islands alone received the brunt of this storm.

In boxing parlance, the first had storm on Jan. 28 amounted to a stinging left jab. But what hit Falmouth and the rest of the Cape Monday was a wicked right cross, a knockout punch from which Falmouth's hard-pressed DPW highway crews even today were still recovering.

"This one was three times worse than the one two weeks ago," was highway superintendent Ronald L. Nielsen's assessment of Monday's blizzard.

Although the accumulation of snow seemed to be greater during the first storm, what did in Mr. Nielsen's forces this time was the bottom layer of the 10- to 14-inch white blanket that covered the town, a three-inch layer of slush turned to ice that tied the smaller, private plows into knots.

The slush quickly froze on the plow blades, "and we just couldn't do anything with it. It's too much for these smaller trucks," said John W. Sylvia, Carriage Shop Road, one of some 20 private plowers who started work Monday afternoon and continued plowing most of yesterday.

He agreed with Mr. Nielsen that Monday's storm was by far worse than the one two weeks ago.

"The snow was really heavy. Instead of it flowing off our plows, it comes off in big chunks. Then you'd hit that bottom layer, and it would freeze right to the plow."

Rain Didn't Help

"The warm weather and the half inch of rain we got didn't help this storm at all. It would have been better a little colder and if we got all snow from the beginning," Mr. Nielsen said. He was referring to Monday morning's 40-degree temperatures.

Complicating problems for the road crews, Mr. Nielsen said, was the fact that he could only muster up a total of 44 plows, including both town and private, to clear the roads.

"I don't know what was the matter. We just couldn't get enough trucks this time. I guess they felt they just couldn't handle it," he said.

He said that three owners of big trucks from the Waltham area called the department. "They said, 'We don't have any snow up here. Can you use us?' I told them come on down."

The three big trucks were still plowing yesterday morning.

In addition, after he and his colleagues declared a snow emergency yesterday morning, Selectman Dufresne called the state DPW, which agreed to send the 10-wheelers.

"We got a lot of drifting, particularly along the shoreline areas. Some places up to ten feet," Mr. Nielsen said. These were the sections the state's big trucks were dispatched to as soon as they arrived here yesterday afternoon. "That and the main arteries," he said.

"We started plowing at about four-thirty last night," Mr. Nielsen said yesterday morning in the DPW garage on Gifford Street, "and they've been at it ever since."

Few Breakdowns

He said the truck breakdown situation was "not bad, not bad at all." He credited the DPW's three mechanics with "keeping the trucks on the road." They are Don M. Swire, Douglas L. Martin and Kenneth A. Souza.

Some residents have a strange way of showing their appreciation for the truck drivers who worked all night to keep their roads passable.

"One lady threw her shovel at my truck up in Tanglewood," said plower Frank Garcia. She apparently was upset when the plow went by, pushing more snow on the driveway she was trying to shovel.

"They were throwing snow-

Continued on Page 14

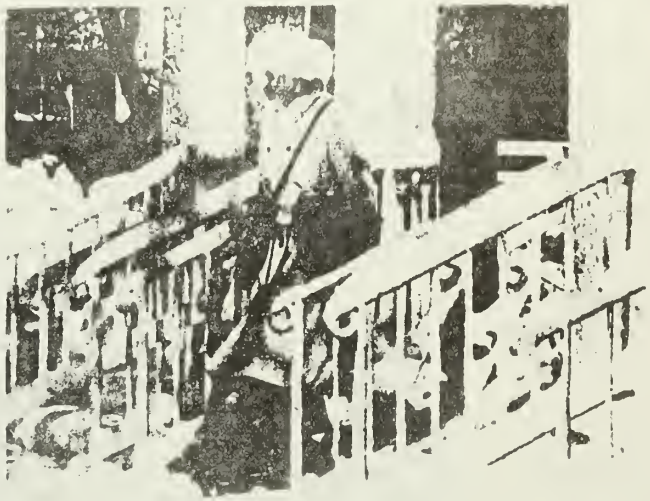
backed away from his car and went around him. It's still there on the road," Mr. Williams said yesterday morning.

Both of the private plowers were in the DPW garage shortly before noon waiting for their next assignment.

Mr. Nielsen came in and said, "I'd like you two guys to go down and get the side streets off Main Street. One take the north side and the other take the south side."

"If they weren't plowed last night," Mr. Sylvia said, "we won't be able to do much good with these trucks."

"Just go down there and do



PRETTY? Yes — But most of us will take our Arctic beauty in smaller doses. This is Nancy J. Rioux of Sippewissett Road, appropriately dressed for the day, leaving the F office. (Photo by Stephen Rose)

Group To Meet
Racial Equality

The Falmouth Committee for Racial Equality will meet tomorrow in the teacher's conference room at Mullen-Hall. The public is in-

Candidates' papers from office nomination clerk/treasurer's office through April 3, and 5 P.M. on April 7 is the deadline for filing them with the registrars of vo-

...ughway Crews

Continued

halls and chunks of ice at my truck," said Mr. Sylvia.

Were they kids or what?

"I don't know. I never saw them. These things kept hitting my window," he said. Mr. Sylvia drives a three-quarter ton Chevrolet four-wheel drive pickup.

"We had one woman, just stood there in front of a plow and wouldn't let it pass. I guess she wanted him to throw the snow on the other side of the street. She just stood there and wouldn't budge ... it's crazy," said Mr. Nielsen.

He added, "We had zero visibility out there last night, and I saw people out in the middle of it in snowmobiles, cross-country skis or just walking. I can't understand those kind of people. You couldn't see them until you were right on top of them."

"Cars, too, right in the middle of the storm, they're out there driving. I don't know where the hell they were going, but they were determined to get there.

Robert Williams, owner of a half-ton Chevy, said, "One guy in Plum Hollow ... I'll put it this way: He was an intoxicated individual, refused to remove his vehicle from the road. I didn't fight with him. I just hacked away from his car and went around him. It's still there on the road," Mr. Williams said yesterday morning.

Both of the private plowers were in the DPW garage shortly before noon waiting for their next assignment.

Mr. Nielsen came in and said, "I'd like you two guys to go down and get the side streets off Main Street. One take the north side and the other take the south side."

"If they weren't plowed last night," Mr. Sylvia said, "we won't be able to do much good with these trucks."

"Just go down there and do the best you can, will you?" Mr. Nielsen asked.

They did.

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NEW ENGLAND NEWSCLIP AGENCY, INC

12
36

Accidents pepper roads as low-salt program tested

By VANESSA PARKS
STAFF WRITER

MDPW

HYANNIS — During an eight-hour period yesterday, about 40 accidents occurred on Route 6 — probably more than that road has seen in the past six months, one state police trooper said.

Within one five-minute span, the Yarmouth barracks received reports of seven accidents — more than they had the staff to respond to, although extra troopers had been called in from the Middleboro barracks.

"It was probably the busiest day in our history today. It was as bad as we've ever seen it," Trooper Robert J. Knott said last night. "Route 6 is absolutely incredible. It's just a skating rink."

There's a good reason why, said Wayne Duchemin, spokesman for the state Department of Public Works. This year the state agreed to cut in half the amount of salt normally used on most Cape roads after local towns expressed concern that the salt would make its way to the ground water — the Cape's only source of drinking water.

"This storm is going to be the litmus test," said Duchemin, referring to the reduced-salt program. "I think it's had a significant effect on the roads. I was on the Mid-Cape myself this morning. It was sheer ice, packed solid. If you rode off-Cape, you'd see the minute you hit the bridge, the roads are bare asphalt.

"We've been concerned about the reduced-salt request for years," Duchemin said. "I think we've been upfront with towns in what the impact was going to be. We told them the reality is that a packed-ice situation will occur on Cape Cod roads. As such, it's incumbent on the drivers to drive safely."

Referring to the 40 accidents on Route 6 yesterday, Duchemin said, "It wasn't because of 'icy roads,' it was because people were driving too fast. People have to understand they're not going to see bare asphalt on the Cape."

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12
35

State nixes road salt plea

MDPW

By VANESSA PARKS
and JACK PERRY
STAFF WRITERS

HYANNIS — Despite a slew of accidents since Monday's blizzard, state Department of Public Works Commissioner Robert Tierney refused requests from local politicians to use more salt on local state highways.

Officials from Barnstable, Yarmouth and Mashpee, as well as the Cape delegation in the Statehouse, asked that Tierney deviate from the new state policy of using less salt on several Cape highways in an experimental program. Although the state public works department had opposed the policy, it was put in place this winter after several years of lobbying for such a program by Cape towns.

"The initial response we got back (yesterday) is, 'Listen, you fought for this policy and now you don't want it anymore?'," said Rep Peter B. Morin, R-Barnstable.

Last night, Morin said several local highway departments reportedly planned to use 100 percent salt on some local roads, despite the state's refusal to use 100 percent salt on state highways.

The situation is blurred by disagreement over interpretation of the low-salt policy. Accidents on Route 6, the Mid-Cape Highway, have become the focus of debate, but the Mid-Cape was never intended to be part of the program, local town officials say.

There were about 20 accidents on the Mid-Cape Highway yesterday morning, and in a three-hour period Tuesday, the state police responded to 40 accidents on the highway, according to state Trooper Joseph MacDonald.

Although five extra state police patrols were assigned to the Cape from the Middleboro barracks, the state police couldn't keep up with the flurry of accidents. They were concerned and frustrated by a seemingly indifferent attitude shown by the department of public works.

"We're concerned with public safety," MacDonald said. "We're the ones that pull these people out of

See SALT, Page 12

...the 50/50 mix because of the reduced road salt policy, Duchemin said.

Local officials disagree with Duchemin's interpretation of the new

...Salt

From Page 1

wrecks and carry them to the hospital."

Martin Flynn, chairman of the Barnstable selectmen, said the state simply refused the request for more salt, without giving a reason.

"I know this is a test year (for the low-salt policy), but when you have 23 inches of snow in a two-week period, you have to say public safety comes first," Selectman Flynn said. "There may be other pressures not to change the policy — I don't know."

Monday's blizzard caused an "extraordinary situation" on Cape Cod, Morin said. "Obviously when we lobbied for this policy, it was keeping in mind the type of winter we normally have on the Cape."

Tierney's assistant, Diana Burkhardt, told the Cape Cod Times yesterday, "We'll do everything possible to get the roads cleared. We'll use all the equipment we can."

But most of the extra state equipment dispatched to the Cape after Gov. Michael S. Dukakis declared a state of emergency here already has left the Cape, said Wayne Duchemin, spokesman for the state public works department. About 40 extra pieces of equipment were sent to the Cape. All of it was used for town roads, the county complex, the airport, and to help Commonwealth Electric Co., Duchemin said. The Cape's regular complement of 10 sanders and 15 to 20 plows took care of the state highways.

By around 4 p.m. yesterday, conditions on the Mid-Cape Highway had improved, but some areas were still "slushy and icy," according to state Trooper Rick Corey.

Duchemin said if a 100 percent application of salt were used, even as late as yesterday, "it would help tremendously. Salt reacts almost immediately and starts to melt the snow." With a mix of sand and salt, much of the mixture is blown off the road by cars before the salt has a chance to take effect, he said.

The state adopted a policy of using 4 tons of sand to 1 ton of salt on Route 6 from the Orleans rotary to Provincetown; on Route 28 from Falmouth Hospital to Orleans, on Route 6A, Route 28A and on the portion of Route 132 for which the state is responsible — approximately from Phinneys Lane to Route 6A

The state said when adopting the policy that there would be no change in policy for Route 6 from the Sagamore Bridge to the Orleans rotary and on Route 28 from the Bourne Bridge to Falmouth Hospital. The mix used on those roads this year and in previous years is an equal mix of sand and salt. In previous years, the state would have used 100 percent salt to deal with the type of conditions the Cape now has. Duchemin said Despite particularly severe road conditions, the state decided to stay with

and on Route 6 from the Bourne Bridge to Falmouth Hospital. The mix used on those roads this year and in previous years is an equal mix of sand and salt. In previous years, the state would have used 100 percent salt to deal with the type of conditions the Cape now has, Duchemin said. Despite particularly severe road conditions, the state decided to stay with the 50/50 mix because of the reduced road salt policy, Duchemin said.

Local officials disagree with Duchemin's interpretation of the new policy. Several officials said they were under the impression that Route 6 from the bridge to the Orleans rotary was excluded from the experimental program. As such, the state could have made the decision to use more salt on that road.

"We were told there was no change in the Route 6 policy and we felt that was good, that it would be a good way to test the program on the smaller roads," said Sherman Reed, a member of the planning and economic development commission's Joint Transportation Committee and chairman of the committee's highway subcommittee. "If I knew that we had been restraining the DPW in emergency measures in any way, I would have initiated measures to stop it." Reed said he thought the state was taking "a pot shot" at the low-salt policy by blaming poor road conditions and Route 6 accidents on it.

Robert Mumford, transportation program manager for Cape Cod Planning and Economic Development Commission, expressed a similar opinion. "I can't emphasize enough that we just had the worst storm we've had in 30 years," Mumford said. "I'm not sure that *any* concentration of sand and salt would have been adequate. I think road conditions are not so much the result of low salt as a result of the worst storm we've had in a long time."

Local officials yesterday expressed concern that the state was trying to sabotage the salt program by doing a poor job of snow removal, thus proving the state was correct in recommending against reduced road salt. No one, however, was willing to be quoted.

Duchemin said such statements were "ludicrous and irresponsible."

"I can't believe people are out there throwing darts at us," Duchemin said. "It's the people of Cape Cod who wanted this policy. We are not trying to ram this policy down their throats. We have really worked hard through out this storm within the constraints of the new road salt policy."

In response to dangerous road conditions, Duchemin said, more applications of the 50/50 mix were used on Route 6. But, he said, two applications of a 50/50 mix are not as effective as one 100 percent salt application.

Another factor in the road plowing debate is the number of people and machines at work. Because of delayed payments, the state has had some problems getting contractors to work for it. This year, the state hired between 100 and 125 private contractors, compared with about 150 in previous years, Duchemin said.

In the past, contractors sometimes have had to wait six to eight months for checks, according to Edward A. Crowell, president of Crowell Construction Inc. in South Dennis.

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HYANNIS, MA
D. 41,821

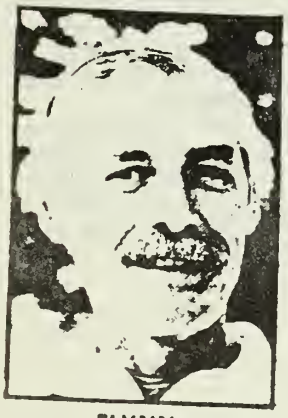
FEB 20 1987

NEW ENGLAND NEWSCLIP AGENCY, INC

13
40

DUCHEMIN

CARBONELL



FLYNN

Officials pepper road salt plan with criticism

By RICHARD HOLMES
STAFF WRITER

BARNSTABLE — Cape officials yesterday called for the state Department of Public Works to use more salt on local highways in extreme storm conditions, such as the Feb. 9 blizzard.

"Under the circumstances we faced, public safety has to be the paramount responsibility," Barnstable Selectman Martin Flynn told his fellow members of the Cape Cod Planning and Economic Development Commission.

The commission met yesterday afternoon in the superior courthouse with regional public works spokesman Wayne Duchemin to discuss the department's reduced road salt policy, which went into effect on Cape Cod this winter.

Duchemin told the commission that although some Cape officials complained about the policy during the recent storm, "to compromise the policy for a few would not be fair."

He asked the commission to "live with" the policy for another month, after which the department would be willing to sit down with local officials and discuss possible changes in the policy.

Commission members informally agreed that the department should be able to use more salt when faced with extreme conditions. They added that they had thought such flexibility already existed in the policy.

Executive director Armando Carbonell said that the policy's inflexibility during the past blizzard was not the fault of Cape selectmen, but of the Department of Public Works.

"Flexibility could have been built in," he said.

The commission agreed to form a task force to study the policy and develop some suggestions for fine-tuning it. This task force will include representatives of the commission, state police, and the department.

For years, Cape officials have asked for the department to limit the amount of road salt it uses. The salt

See ROAD SALT, Page 10

3

...iewed by officials

...reaches into the Cape's ground water and contributes to the salinity of Cape drinking water.

At yesterday's meeting, Eastham scientist Joseph Moran provided evidence that road salt ends up in ground water.

Moran said water taken from Eastham wells that are within 200 feet of Route 6 have an average sodium content of 27 milligrams per liter. He compared this with the average sodium content of Eastham wells, which he said was 20 milligrams per liter. Moran's data did not include wells located near the coast, where they might be affected by saltwater intrusion.

Last fall, the department agreed to change its road salt policy by saying that most Cape highways would be treated with a four-to-one mixture of sand and salt.

The exceptions to this policy are Route 6 from the Sagamore Bridge to the Eastham Rotary and Route 28 from the Bourne Bridge to where the highway changes from four lanes to two in Falmouth. These two areas are treated with a 50-50 mix of sand and salt.

The policy made one other significant change. Unlike previous years, the department no longer applies a layer of 100 percent salt at the outset of a winter storm.

Cape officials welcomed the change until the recent blizzard, when ice and snow remained on state roads for many days. But they insisted at yesterday's meeting that they wanted to keep the reduced salt policy.

Duchemin said outside the meeting that one reason the department is hesitant to immediately change the policy is the difficulty in changing its work crews' habits. He said it was very hard to get the crews to accept the new policy.

He added that the department expected some problems with the policy when it instituted it.

"We went into this policy with the understanding that there'd be some bugs to work out," he said.

Duchemin said the condition of the Cape's highways following the Feb. 9 blizzard "obviously was not what we like them to be." But he added that there was nothing more that the department could have done to clear the roads and still adhere to the policy's limits.

"We knocked ourselves out," he said.

During the meeting, commission members had varied in their descriptions of state roads after the recent blizzard. While all said some snow and ice remained on the roads for days, some found this temporary condition acceptable in light of the storm's magnitude.

Outside the meeting, Duchemin said ice and snow removal efforts were hampered by the number of people who persisted in driving, which packed down the snow on the roads. He also said that work crews were subject "to a lot of abuse that they didn't deserve" from Cape Codders angry with the poor road conditions.

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13
38

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In Our View

Keep the diet

Doesn't it always happen this way?

Just as soon as you get what you want, the most amazing thing occur, and you can't imagine why you wanted the blamed thing the first place.

Take, for example, the low-salt diet to which Cape roads are being treated this year. For years, Cape officials asked the state Department of Public Works to limit the amount of road salt it uses during snowstorms. The salt does a great job of melting ice and snow, but scientists believe that road salt ends up in ground water.

Finally, the DPW last autumn agreed to reduce the salt content of its sand-and-salt mixture just about everywhere on the Cape. The DPW also said it would no longer apply a layer of pure salt along the roads at the beginning of a storm.

The snow gods must have been listening to those pronouncements and smiling their brittle smiles. Almost immediately, it seemed, the snow belted us.

Two blizzards two weeks apart dumped more snow on our landscape than we had seen in any full year in at least the past 15. The latter storm brought up to 18 inches of snow, and without their traditional dose of salts, road crews were unable to clean the roads satisfactorily.

Because of this, a cry is going up to increase the amount of salt applied to Cape roads during snowstorms. Proponents cite the 4 accidents that occurred Feb. 11 on Route 6, the many traffic mishaps on secondary roads, and the reduced ability of emergency vehicles to get where they have to go.

We believe there should be some mechanism for allowing an increase in the amount of salt to be applied to the roads, but it should only be effected when true blizzard conditions are forecast.

An increase in the amount of salt during blizzards ought to improve the public safety without affecting water quality. For even as we look out and see snow everywhere, we must aknowledge that in an average winter we don't get socked that hard, that often.

Rules such as the one limiting road salt are meant for an average year. In the long run, people will be healthier for it.

But in a blizzard, it's not reasonable to adhere rigidly to this rule while ignoring the real risk of people dying on roads that cannot be cleaned.

Appendix F
Salt Reduction Data for Cape Cod

APPENDIX F

Tabulated below are salt usages for all Cape Cod repair sections for the last five winter seasons, including 1986 - 1987, showing the percentage reductions.

SECTION 6 FALMOUTH

Year	Lane Miles	#Snow	#Ice	Accum.	Tons NaCl	Tons/LM
1982 - 1983	99	6	6	36½	1326	13.39
1983 - 1984	99	6	13	23	1446	14.60
1984 - 1985	160	20	8	32-3/4	2313	14.45
1985 - 1986	160	17	13	29½	2924	18.27
			Average		-	15.18
1986 - 1987	160	18	20	65-3/4	934	5.83

5.83/15.18 = .38

62% reduction in NaCl

SECTION 7 SANDWICH

Year	Lane Miles	#Snow	#Ice	Accum.	Tons NaCl	Tons/LM
1982 - 1983	75	6	4	39-3/4	987	13.16
1983 - 1984	75	12	9	33-3/4	2620	34.93
1984 - 1985	115	21	12	34¼	2535	22.04
1985 - 1986	115	16	15	26	3535	30.74
			Average		-	25.22
1986 - 1987	115	21	17	65	1018	8.85

8.85/25.22 = .35

65% reduction in NaCl

-cont.-

SECTION 8 YARMOUTH

Year	Lane Miles	#Snow	#Ice	Accum.	Tons NaCl	Tons/LM
1982 - 1983	182	7	5	40¼	2793	15.34
1983 - 1984	182	9	12	29-3/4	2733	15.02
1984 - 1985	162	21	15	36½	2364	14.59
1985 - 1987	162	20	16	31	2525	15.28
			Average		-	15.13
1986 - 1987	162	21	23	64	1011	6.24

6.24/15/13 = .41

59% reduction in NaCl

SECTION 10 ORLEANS

Year	Lane Miles	#Snow	#Ice	Accum.	Tons NaCl	Tons/LM
1982 - 1983	148	7	5	30½	1807	12.21
1983 - 1984	148	9	12	23	2217	14.97
1984 - 1985	155	16	4	30	1380	8.90
1985 - 1986	102	19	9	24¼	1160	11.37
			Average		-	11.86
Test 1985 - 1986	24		74.96			3.12
Control 1985 - 1986	29		172.15			5.93
Control 1986 - 1987	155	19	16	64¼	352	2.27

2.27/11.86 = .19

81% reduction in NaCl

Average NaCl reduction on Cape Cod

62+65+59+81/4 = 67% reduction